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# USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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**ELECTRONICS AND ELECTRICAL ENGINEERING**

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FEATURES OF DESIGN OF ANALOG-DIGITAL ACOUSTIC SIGNAL LEVEL METERS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 85 pp 3-9

NEKRASOV, B. V. and NIKONOV, A. V., Moscow Electrotechnical Communications Institute

[Abstract] The construction principles and design features of modern analog-digital acoustic signal level meters are examined. One promising type of display device for use in analog-digital level meters is a discrete scale indicator of the bar graph type with more than 100 elements, which provides good accuracy, sufficient brightness, and ease of reading. Serial analog-digital converters are recommended for controlling such indicators. A standard structural diagram is presented that can serve as the basis for future analog-digital level meters. A microcomputer-based design method is presented that simplifies the design of analog-digital level meters. Figures 7. References 11: 9 Russian, 2 Western.

[284-6900]

POWER ENGINEERING

UDC 621.315.017

CONCERNING REDUCTION OF ELECTRICAL ENERGY CONSUMPTION CAUSED BY TRANSPORT

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 85 pp 2-4

ANTINOV, K. M., candidate of technical sciences, Main Technical Administration, Ministry of Power and Electrification, USSR

[Abstract] Reasons are given for high consumption of electrical energy in the USSR caused by its transportation. As an example, the high concentration of electrical energy production and its remoteness from the centers of advance consumption lead to an increase of the distance of transportation of electrical energy and consequent loss of electrical energy. At present the USSR Ministry of Power and Electrification is attempting to: 1) Improve systems of accounting and supervision of production, distribution and use of electrical energy; 2) Improve methods for calculating, forecasting, and planning losses and choice of measures with respect to reduction; 3) Introduce programs, development and measures with respect to a reduction of energy losses; 4) Improve organization of work with respect to a reduction of losses, extension and propagation of advanced practices. Most of the work of the plan, connected with development of branch instructions, improvement of calculation methods, and introduction of programs is carried out by subdivisions of the USSR Ministry of Power and Electrification: All-Union Scientific Research Institute of Electric Power Engineers (VNIIE), All-Union Technical Energy Association (Soyuztekhenergo), All-Union Order of the October Revolution State Planning, Surveying, and Power System and Electrical Power Network Design and Scientific Research Institute (Energosetproyekt) and Agricultural Power Design Institute (Sel'energoprojekt). Higher educational institutions take part in only two operations: the Belorussian Polytechnical Institute, together with the Belorussian Department of the Energosetproyekt introduce into the Belorussian Main Power Supply Administrative automated system of calculation, analysis and planning of energy losses in electrical networks, and the Tallin Polytechnical Institute takes part in the development and production of a device for group control of capacitor banks.

[269-6415]

UDC 621.313.322-81.017.072.001.5:669.14

INVESTIGATION OF QUALITY OF PRESSING OF ACTIVE STEEL OF TURBOGENERATOR  
STATOR WITH WATER COOLING OF WINDING

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 85 pp 31-33

IZARYAN, E.V., KARTASHEVSKI, P. Ya., engineers, LIVSHITS, A. A., candidate  
of technical sciences, MALIKOV, Ch. M., RUBTSEV, V.P., engineers, Scientific  
Research Institute of Heavy Electrical Machinery Plant--Maryyskaya State  
Regional Electric Power Plant.

[Abstract] In spite of serious investigations of the use of laminated cores, recommendations making it possible to avoid weakening of pressure in the outer laminations of the cores of power turbogenerators have been lacking and the paper is concerned with the development of a system for diagnosis of the pressing of a stator core. Its basis is a system of monitoring of the pressure state developed by the Scientific Research Institute of the Heavy Electrical Machinery Plant and the Georgian Scientific Research Institute ECS (expansion unknown). It is concluded that the possibility exists of using the diagnostic system developed, not only to detect a dangerous change of the pressure state, but also to optimize the regimes of heating and cooling of the generator from the point of view of the thermomechanical processes in the stator. It becomes possible to evaluate the effectiveness of technological and construction measures directed towards increasing the monolithicness of the stator core. In contrast to the majority of diagnostic systems, the system described here does not require frequent applications of the operational personnel. Because a change of the state of the arranged lamination packets is a slow process, measurements and analysis of the pressures in the core can be performed during preventive checks or inspections of possible causes of faulty conditions connected with the state of the core. Figures 3; references 2 Russian.  
[269-6415]

UDC 621.315.1.017.71(575)

CONCERNING HEATING OF OVERHEAD LINE CONDUCTORS UNDER HOT CLIMATE CONDITIONS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 85 pp 49-51

TREYGER, A.S., MACHKHELYANTS, Z.A. and VARVARIN, G.I., engineers, Central  
Asia Technical Energy -- Ministry of Power and Electrification, Uzbekskaya  
Soviet Socialist Republic (Sredaztekhenergo - Minenergo UzSSR)

[Abstract] The paper presents a statistical-probability analysis of the heating of conductors under hot climate conditions. It is shown that in the summer with ultimate current loads the temperature of the conductor reaches 80-90° C. Such superheating of the conductors above the maximum temperature of the air by which the maximum sag is determined can lead to a significant disturbance of the normal PUE (rules for setting up electrical installations)

clearances. For an increase of the capacity of lines during design work as well as with the goal of liquidation of possible disturbances of the clearance, it is recommended that an estimate be made of the maximum temperature load of the conductors, allowing for the load current and the solar radiation for concrete climatic conditions, and that the maintenance of clearances with the temperature sags corresponding to them be checked. Figures 1; tables 1; references: 4 Russian.

[269-6415]

UDC 621.315.17.088

#### ITERATIVE METHOD OF CALCULATING LOCATION OF OVERHEAD LINE DAMAGE

Moscow ELEKTRICHESKIY STANTSII in Russian No 3, Mar 85 pp 54-57

BELYAKOV, Yu. S., PYANIKOV, V. Ya., Engineers, KARELENERGO (Karelian Power)

[Abstract] Determination of damage location (DDL) of overhead electrical lines remains an important operational problem which has great economic and technical effect. The present paper, which describes various forms of DDL is principally concerned with the iterative method of DDL. This method is based on detecting the maximum of a certain auxiliary function. It is suitable for a wide class of overhead lines, forming complex schemes. Including mutual induction, it does not introduce limitations on the use of various parameters of overhead lines. The function used, whose minimum of which is found, is the difference of the square of the ratio of currents and voltages with respect to the ends of the overhead line reduced to calculating the ratio of a given point of the short circuit, and to sum with respect to all ratios. This function can serve as a standard of error of DDL; on its basis it is possible to calculate the by-pass zone with the required probability of entrance into it. The authors conclude that the proposed method gives the possibility of using a program of calculation of short-circuit currents for DDL purposes. Figures 2; tables 1; references: 7 Russian.

[269-6415]

UDC 621.315.2.016.2.001.4

#### RESULTS OF TESTS OF MARK AASHV(ozh)3 x 95-6 CABLE

Moscow ELEKTRICHESKIYE STANTSII in Russian No 3, Mar 85, pp 57-61

KUKHTIKOV, V.A., TIMONIN, V.K., and TREST, L.Ye., engineers, High-Voltage Apparatus Scientific Research Center -- All-Union Technical Energy Association

[Abstract] In 1971-1972, The Moscow Power Engineering Institute (MEI) with the participation of the All-Union Scientific Research Planning-Design and Technological Institute of the Cable Industry (VNIIKP) and the High-Voltage

Apparatus Scientific Research Center (NITsVVA) conducted an experimental investigation of heating Mark AABG and AAShB power cables by short circuits at a 6 kV voltage. On the basis of tests conducted on short lengths of cable (length 5-6 meter) it was concluded that the breakage of the core, and ignition of the insulation, with steady leakage short-circuit currents proceeds as a rule to terminal sealing with the heating temperature of the current conducting core above 500° C, and it was proposed to consider 500° the maximum temperature with respect to conditions of fire resistance of a cable. However, up to now no analyzed values of the fire resistance temperature of power cables existed, and the necessity arose for experimental tests of the thermal effect of short-circuit current on the cable Mark AAShv (Ozh)3 x 95-6, which is the most widely used in cable networks for the basic needs of electrical stations. This paper discusses these tests and their results. Figures 5; tables 1; references: 2 Russian.

[269-6415]

UDC 621.3.001 + 538.5

#### CALCULATION OF EFFECTIVENESS OF SHIELDING BY PLANE SHIELDS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 2, Mar-Apr 85 (manuscript received 3 Oct 84) pp 8-12

PENTEGOV, I.V., doctor of technical sciences, Chief of Laboratory, Institute of Electrical Arc Welding imeni Ye. O. Paton, Academy of Sciences, Ukrainian SSR, Kiev, and TARASENKO, O.A., chief of laboratory Nizhnedneprovskiy Pipe Rolling Plant.

[Abstract] Formulas are developed for calculation of plane metallic shields which assure the required level of shielding of electromagnetic fields. A number of simple estimation formulas are obtained, which are strictly correct for flat shields and plane electromagnetic waves incident to the shield normal to the surface of the shield only when there exist transverse components of the vectors E and H. Figures 1; references: 6 Russian.

[266-6415]

## DIRECT FREQUENCY CONVERSION IN GATE CIRCUITS

Kiev TEKHNICHESKAYA FLEKTRODINAMIKA in Russian No 2, Mar-Apr 85 (manuscript received 16 July 84) pp 44-53

PYANYKH, B.Y., candidate of technical sciences, senior scientific coworker, Institute of Electrodynamics, Academy of Sciences, Ukrainian SSR, Kiev, CHEKET, E.M., candidate of technical sciences, Institute of Electrodynamics, Academy of Sciences, Ukrainian SSR, Kiev, CHERZOVSKIY, Z., doctor of sciences, director Institute of Electrodynamics, Academy of Sciences, Ukrainian SSR, and LETTA, I., candidate of sciences, Institute of Electrotechnics, Academy of Sciences, Ukrainian SSR.

[Abstract] Some problems of direct frequency conversion in gate circuits are considered. Principal attention is focused on methods of improvement of the form of the output voltage and current during conversions. Methods are considered to obtain an equivalent multiplier of those number, pulse-width regulation, and pulse-width modulation. The main relationships which determine the dependence of the amplitude of the principal and higher harmonics of the voltage and current on the multiplicity factor  $k$  are considered. Nonsymmetrical regimes in direct frequency conversions with single modulation are analyzed. Figures 7; references 4: 3 Russian, 1 Western.  
[266-6415]

## COMPUTER-AIDED ANALYSIS OF CIRCUITS FOR POWER ELECTRONICS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 18 Jul 84) pp 3-6

VASIL'YEV, A.S., doctor of technical sciences, department head, DZLIYEV, S.V., candidate of technical sciences, docent, FEDOSIN, S.A., graduate student, and BLINOV, Yu.I., junior scientific associate, Leningrad Institute of Electrical Engineering

[Abstract] A subsystem supplementing the computer-aided design of ionic and semiconductor power devices has been developed at the Department of Electrotechnology and Electric Power Conversion Engineering, specifically for simulation and analysis in the time domain of diode rectifiers, inverters, and frequency converters. The structure of this PAKLS subsystem consists of six interconnected modules. There are a circuit model module between the data input+interpretation module and the standard processing plan data output module, a model control module between the data input+interpretation module and the nonstandard processing plus data output module, and a signal generator also driven by the data input+interpretation module and connected to the circuit model module. There is mutual data exchange between the circuit model

module and the model control module as well as between the model control module and the signal generator. The circuit model module generates mathematical equations of an electric circuit on the basis of state variables and solves these differential equations by numerical methods, with adaptation to changes in the rectifier operating mode. It also determines the timing of commutation events and establishes the initial conditions for subsequent transients. The model control module simulates excitation, voltage or current feedback, and other control processes. It also organizes computer experiments with programmable changes of device topology and circuit parameters at given instants of time or under given constraints, generates target functions and constraints for parametric optimization on the basis of dynamic estimates, and simulates the dependence of variable sources and circuit elements by approximating it with piecewise-linear static characteristics. The signal generator produces test pulses independently for each rectifier channel. The algorithms of this PAKLS subsystem are compatible with any available disk operating system or YeS-computer operating system. Their performance is demonstrated on analysis of dynamic processes in a centralized electric power supply with a 3200 kW - 2.4 kHz static converter for induction furnaces in a forging mill. During the first 25 periods of the starting transient the converter is excited in antiphase through an isolating capacitor and a switching capacitor, both precharged. During the second stage control pulses are applied to the low-power inverter bank while the feedback loop is closed and the resulting new control action pulls the power supply into output voltage stabilization. Figures 3.

[270-2415]

UDC 621.313.5:533.95

#### ENERGY RELATIONS DURING DISCHARGE OF LINEAR PULSE GENERATOR INTO ELECTRO-DYNAMIC ACCELERATOR OF CURRENT CONDUCTORS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 28 Mar 84) pp 7-12

BONDALETOV, V.N., doctor of technical sciences, division head, PETROV, S.R., and TYUTKIN, V.A., candidate of technical sciences, section head, All-Union Institute of Electrical Engineering, Istra branch

[Abstract] A linear pulse generator with self-excitation is considered for high-speed electric propulsion, namely for energizing an electrodynamic accelerator of current conductors. The energy characteristics of such a generator operating in the acceleration mode, with pulse discharges into an effectively resistive-inductive load which varies in time, are analyzed and compared with its energy characteristics in the power generation mode. The accelerator consists of a piston which slides between two electrodes connected to the excitation source through a commutator switch and drives a conductor sliding between two busbars connected to the electrodes through a resistance and an inductance respectively, with a shunting switch also connected in parallel across the electrodes. The system of three differential

equations describing the transient electrical and mechanical processes in this system, with local effects at the electrodes disregarded, is formulated nondimensionally in per-unit quantities and solved for the energy components in the system. The results reveal that the efficiency of such a generator will be highest when the equivalent resistance of piston motion is at least three times the electrical resistance of the discharge circuit, and that the ratio of kinetic energy in the moving conductor to initial magnetic energy in the generator with power losses and flux leakage will be highest either when the generator is shunted after compression of the magnetic flux or when flux compression and conductor acceleration are separated in time with the piston not stalling completely during flux compression. Figures 5; references 5: 4 Russian, 1 Western (in Russian translation).  
[270-2415]

UDC 621.311:519.24

OPERATIONAL ASSURANCE OF PERFORMANCE PARAMETERS RELIABILITY IN ELECTRIC POWER SYSTEM BY METHOD OF LEAST MODULI

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 14 Oct 84) pp 73-77

CHERNENKO, P.A., candidate of technical sciences, senior scientific associate, and CHUKHNO, V.I., graduate student, Institute of Electrodynamics, UkrSSR Academy of Sciences, Kiev

[Abstract] Effective control of an electric power system requires reliable data on its state and performance parameters, usually obtained by statistical estimation and prediction including rejection of unreliable data. The method of least moduli is proposed for better data reliability assurance, this method being much more sensitive to spurious overshoots than the conventional method of least squares with use of a Kalman filter. The problem of minimizing the modulus target function is solvable exactly by methods of conditional linear optimization, but can be solved approximately with appreciably fewer arithmetic operations by the method of centroidal components. Fewer principal components are needed here than in the algorithm so that the vector of fictitious variables simulating the actual system variables is lower and the accuracy improves, although the accuracy of this method is poorer than that of least squares. Its algorithm is sufficiently fast, however, for system control in real time. Another advantage of this method is that it accounts for the interrelation between system parameters and avoids false rejection of data during fast wide swings in the power system. The method was tested and proved in the Leningrad regional power system, with data from a sample of 16 load points used for control. Figures 2; tables 2; references 7: 5 Russian, 2 Western (1 in Russian translation).  
[270-2415]

USE OF COMMERCIALLY PRODUCED TURBOMOTORS IN CONTROLLED ELECTRIC DRIVES

Moscow ELEKTROTEKHNIKA in Russian No 4, Apr 85 (manuscript received 31 Jul 84)  
pp 6-10

KOLOKOLKIN, A.M., engineer, LEBEDEV, N.I., candidate of technical sciences, LUPKIN, V.M., candidate of technical sciences, NATALKIN, A.V., candidate of technical sciences, and SAMOYLOV, I.N., engineer

[Abstract] Speed regulation for optimization of technological processes is required in many industries using synchronous turbomotors, especially series STD and STM machines commercially produced in sizes ranging from 800 to 12,500 kW. A typical example is the STD-6300 turbomotor whose speed must be regulated over the  $(0.6-1.1)n_{\text{nom}}$  range. The problem of speed regulation by operating these motors together with high-voltage frequency converters is analyzed from the standpoint of design and performance of such a thyristor-motor system on the basis of theory, GOST-183-74 specifications, and experimental data. Into account are taken starting and running characteristics, especially power requirements and heating. Tests were performed at the Central Institute of Aerohydrodynamics imeni N.Ye. Zhukovskiy and at the Institute of Power Engineering imeni G.M. Krzhizhanovskiy with an STM-12000-2 motor and an SPChR-11000/10 thyristor-bank frequency converter. Both calculations and measurements have established the technical feasibility of a thyristor-motor drive with desirable speed regulation. One problem is avoidance of critical speeds within the regulation range, which requires a special motor design. Another problem is the extra power loss in the motor with attendant extra heating under a nonsinusoidal input voltage, which limits the power rating of the motor and requires an oversize motor: one size larger than would be otherwise adequate. Figures 3; references: 11 Russian.

[261-2415]

BROADCASTING, CONSUMER ELECTRONICS

UDC 681.7.067.252.6

TWO-COMPONENT VARIABLE OBJECTIVE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 17 Jul 84) pp 70-75

OSKOTSKIY, M. L. and KHVALOVSKIY, V. V., Leningrad Institute of Precision Mechanics and Optics

[Abstract] An analytical method is examined in the paraxial domain and in the domain of third-order aberrations for a variable objective used in color TV cameras with a long rear section, telecentric travel of the main rays, and fixed aperture angle in the image space. The values of the basic parameters of the components are found. The best region of solutions is  $W_1 = 0.5-0.7$ . Figures 4. References: 2 Russian.  
[296-6900]

UDC 621.397.611.037.372

EXPERIMENTAL INVESTIGATION OF DIGITAL VIDEO RECORDING SYSTEM

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 85 pp 18-27

SHTEYN, A.B., TSIZIN, L. Ye. and TESLER, A. V., All-Union Scientific Research Institute for Television and Radio Broadcasting

[Abstract] The status of projects for defining the basic parameters of digital video recording equipment is reviewed. Findings are presented based on an experimental digital video recording system with a data rate of 80 mbps developed by the Scientific Research Institute for Television and Radio Broadcasting. It is found that digital audio and video reproduction quality can be nearly indistinguishable from the original. In spite of the use of integrated circuits, digital equipment is significantly more complicated than analog counterparts. The proposed international standard 19-mm tape format makes it possible to use high-performance tape 16  $\mu$ m thick. Experiments show that existing magnetic tapes are unsuitable for digital operation because of their excessive error factors. The segmented record format simplifies the

video recorders technically, and permits the use of video heads manufactured using traditional technology. Figures 16. References 11: 7 Russian, 4 Western.

[284-6900]

UDC 621.373.13:621.397.61:681.772.7]:621.391.822

INFLUENCE OF NOISE OF SWEEP GENERATORS IN TRANSMITTING TV CAMERAS ON IMAGE QUALITY

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 85 pp 33-35

AZIMOV, Ye. I., All-Union Scientific Research Institute for Television and Radio Broadcasting

[Abstract] This study investigates the influence of the noise of linear sweep generators employed in transmitting TV cameras on the quality of the image produced by the camera. The structural diagram of a linear sweep generator is presented and analyzed. It is found that the use of high-gain operational amplifiers causes a significant noise component in the deflection current due to resonant amplification of the intrinsic noise of the operational amplifiers. The noise current in the frame sweep generator degrades image quality significantly. It is found that the noise current can be suppressed effectively by changing the amplitude-frequency characteristic of the frame sweep generator. Figures 1. References: 6 Russian.

[284-6900]

UDC 621.396.62

DESIGN OF INTERMEDIATE FREQUENCY FM CIRCUITS FOR HIGH PERFORMANCE STEREO-PHONIC RECEIVERS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 16 May 83) pp 31-34

DENIN, A. Ye.

[Abstract] The characteristics and designs of the multiple-tuned transformer circuits, the amplifier limiter, the frequency detector, the readout circuits and noise-free tuning circuits employed in high performance stereophonic receivers are examined. The basic electrical parameters of the IF FM circuit are tabulated. The simultaneous realization of good selectivity and low distortion of the processed signal in designing the selection circuit are discussed. These contradictory requirements are resolved by using two-band multiple-tuned transformers, or else special circuits such as the "non-spectral" selection circuit employed in the L-02T tuner (Japan). The use of surface acoustic wave filters is also promising. Comparison of ratio-type, coincidence-type, counting-type and phase-locked loop frequency detectors

indicates that the ratio detector provides the best performance. Figures 6.  
References 10: 9 Russian, 1 Western.  
[286-6900]

UDC 621.396.97:621.376

#### AUTOMATIC SIGNAL LEVEL LIMITER FOR RADIO BROADCAST TRANSMITTER MODULATOR

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 5 Dec 83)  
pp 28-30

MAKAROV, A.V.

[Abstract] An automatic level limiter that pre-amplifies the signal and limits its level to prevent overmodulation of the transmitter when the input signal rises above the nominal level is described. The limiter, which is based on integrated circuits, provides a display to indicate the limiting mode. The block and schematic diagrams of the device are presented and analyzed, and the electrical parameters are tabulated. The device satisfies the technical requirements for devices of this class employed in stationary radio broadcast transmitters. An experimental model of the limiter is undergoing long-term testing in a modernized medium-wave radio broadcast transmitter. Figures 3.  
[286-6900]

UDC 621.395.66

#### NOISE IN BROADCAST CHANNELS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 18 Nov 84)  
p 35

ASHRAFYAN, S.P., NAZIMOVA, A.A. and SHISHKINA, N. N.

[Abstract] Determination of the psophometric noise power in broadcast channels formed by combining voice grade channel bands is analyzed. It is found that the psophometer developed in accordance with CCIR Recommendation 468-2 can be employed in the YeASS broadcast network, as long as a 4-dB correction is made to the corresponding noise level standard to account for change in the characteristic of the weighting filter, and a 5-dB adjustment to correct for the use of a quasi-peak detector. The "one-time" noise levels in this case will correspond to the CCITT standards for different broadcast channel classes 95% of the time. References: 7 Russian.  
[286-6900]

UDC 681.828.3

DEVICE FOR INVESTIGATING PROPERTIES OF BROADCAST SIGNAL ENVELOPE

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 22 Dec 82)  
pp 36-37

PAPERNOV, L. Z., GRISHIN, M.I., LEVI, V.M. and MOLODAYA, N. T.

[Abstract] A device is investigated for studying the properties of the envelope of real music and speech signals. The structural diagram of the device, which extracts the signal envelope over a wide dynamic range for subsequent processing and investigation, is shown. The signal source is a professional-quality tape recorder that outputs a level-calibrated signal to the envelope extractor. The envelope is input to a statistical analyzer, and white noise at a fixed level is applied to the reference input of the modulator, which outputs a high frequency AM noise signal that contains information about the envelope of the signal under investigation. The schematic diagram of the envelope extractor, which is based on K14OUD8A operational amplifiers, is presented. It is found experimentally that the envelopes of signals representing the same text read with different emotional coloring differ significantly. Figures 2. References: 2 Russian.  
[286-6900]

UDC 621.396.97:621.391.25

INPUT-OUTPUT DEVICE FOR COMPUTER PROCESSING OF AUDIO BROADCAST SIGNALS

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 4 Nov 83)  
pp 19-23

DENISOV, V. I., KOROLKOV, V. V. and MITROFANOV, Yu. N.

[Abstract] The suitability of the ES 7903.M input-output device, with analog-digital and digital-analog converters connected to its control rack through specially developed interface circuits, for digital processing of audio broadcast signals is evaluated. Structural, logic, and timing diagrams of the device are presented and traced. A program written in the Assembler algorithmic language is presented for entering 400 kbyte of digital broadcast signal information, reading it and outputting it to an analog tape recorder is presented. The device is helpful for mathematical modelling of digital audio broadcast transmission systems in real time on YaS series computers. Figures 5. References: 3 Russian.  
[286-6900]

## CCIR RESEARCH ON TELEVISION

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 19 Nov 84)  
pp 58-62

KRIVOSHEYEV, M. I.

[Abstract] Reports produced by CCIR Research Committee 11 on the following themes are summarized: standard monochrome and color television systems, additional television services, assessment of TV image quality and parameters affecting it, technical data for planning TV networks, projection ratios, television receivers, and antennas, international exchange of TV programming, testing and measurement, digital television, TV program recording, and TV satellite broadcasting. A report on digital transmission of TV audio, and technically suitable modulation methods, is also discussed.

[286-6900]

## CONSULTATION ON WIRED-RADIO BROADCASTING

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 45-46

DOLGOV, V. I., deputy chief, Moscow Municipal Wired-Radio Network

[Abstract] Data on the parameters of the NT-220-101 horn-type loudspeaker are published in response to a reader's request. The NT-220 speaker is a miniature device designed primarily for reproducing informational programming in open spaces, such as railroad stations, sports arenas, machine rooms, and other noisy areas. The speaker can accommodate 5, 10, or 20 volts (switchable), with line voltage of 100-120 V; the standard frequency range is 315-5000 Hz, with characteristic sensitivity (1 W, 1 m) of 105 dB (with respect to  $2 \cdot 10^{-5}$  Pa.) The installation procedures of the speaker are outlined. Figures 3.

[288-6900]

## INTERVIEW WITH SERGEY IVANOVICH KHOVIN, CHIEF, UNION RADIO BROADCAST AND RADIO COMMUNICATIONS CENTER NO. 1

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 6-8

MAKSIMOVA, N.

[Abstract] The work performed by Union Radio Broadcast and Radio Communications Center No. 1 to win the 1984 All-Union Socialist Competition is described. Center No. 1 transmits the programs produced by the State Committee on Television and Radio Broadcasting, and also transmits information for TASS, for the Chief Radio Meteorological Center, and for the Novosti news agency. The main function of the center is to provide uninterrupted, high-quality radio

communications and radio broadcasting. The role of socialist competition in the activity of the organization is described. Innovative management procedures implemented to improve performance indicators are described. Steps being taken to promote the social development of the personnel at the Center are outlined, and plans for 1985 are summarized. Figures 2.

[288-6900]

#### DIAGNOSTIC TESTER

Moscow RADIO in Russian No 4, Apr 85 pp 29-30

SOLODOV, Yu.

[Abstract] A diagnostic tester is described for fault tracing in model UPIMTsT-61 and UPIMTsT-67 televisions. The device is capable of monitoring six fixed voltages and four pulse voltages in the sweep and power circuits, making it possible to detect defective components rapidly that are difficult to identify simply by replacing modules. The schematic diagram of the device is presented and explained. Display is provided by 10 light-emitting diodes. The board component layout and foil pattern are presented. Figures 3.

[290-6900]

#### "ELECTRONIC CLOCK" HOBBYIST KIT

Moscow RADIO in Russian No 4, Apr 85 p 62

[Abstract] The Start 7176 electronic clock kit is described. The kit includes a printed circuit board, a K145IK1901 LSI circuit, an IVL1-7/5 luminescent vacuum display, an RV-76 quartz resonator, in addition to resistors, capacitors, diodes, etc. The clock that can be built from the Start 7176 kit provides accuracy of at least  $\pm 0.5$  seconds per day, and consumes approximately 6 W from a 220 V line. The board is 130x90 mm, and the clock with power supply weigh no more than 400 grams. The K145IK1901 microcircuit serves as a microcontroller, and can also be set to a timer mode for a period of 59 minutes and 59 seconds. Two alarm modes are also provided. The kit costs 16 rubles. Figures 2.

[690-6900]

#### ELECTRONIC MUSIC SYNTHESIZER KEYBOARD INTERFACE AND TONE GENERATOR

Moscow RADIO in Russian No 4, Apr 85 pp 44-47

KUZNETSOV, A., MITRIY, D. and PECHATNOV, B.

[Abstract] This is the first part of a two-part article on the keyboard interface and tone generator for an electronic music synthesizer. Two keyboard

interfaces are described: one in which the binary signal is converted to control voltage by an exponential digital-analog converter, and one in which a simple 10-bit linear digital-analog converter is used to provide relative frequency accuracy of 0.1% throughout the entire musical range of the synthesizer by converting the output voltage exponentially. Schematic and timing diagrams of both versions are presented and explained. Figures 5.  
[290-6900]

## USE OF STANDARD TOWERS TO HOLD DECIMETER-BAND TV ANTENNAS

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 36-37

OMELYANENKO, Yu. I., candidate of engineering sciences, chief, RURT, Ukrainian SSR Ministry of Communications, and MEDVINSKIY, S. A., chief mechanic, RURT

[Abstract] The placement of standard four-tier decimeter-band antennas on towers serving existing TV stations is described. With the proposed approach, the standard turnstile antenna is replaced by a standard four-tier decimeter-band antenna at the top of the tower. The prismatic part of the tower accommodates the six-tier panel antenna for bands I and II, as well as the antenna for band III. The antenna for bands I and II is placed 25 m below the replaced turnstile antenna. This arrangement provides the same TV coverage, inasmuch as the gain is practically twice that of the turnstile antenna. Replacement procedures are described that make it possible to use the standard tower for single-program broadcasting to set up broadcasting of three or more programs in bands I through V without building new towers, or modifying existing ones. Figures 4.

[283-6900]

## MULTIBAND DIRECTIONAL SHORT-WAVE ANTENNA

Moscow RADIO in Russian No 2, Feb 85 pp 21-22

GUTKIN, E. (UB5CE), USSR Sports Master, Voroshilovgrad

[Abstract] The first part of this article appeared in RADIO No 1, Jan 85. Here the method of tuning the multiband directional short-wave antenna is described. The procedure involves successive measurement of the antenna parameters with the antenna raised to its operating altitude and receiving a stable signal from the test generator, then checking the radiation pattern in all frequency bands, analysis of the data and, if necessary, corrective adjustments. Six precautions ought to be taken: 1) the antenna performs poorly when mounted low above a reinforced-concrete roof, its directivity being worse along than across such a roof and a minimum of 8 m above the roof being acceptable; 2) when the SWR in the feeder cable varies with rotation of the antenna, this indicates interference from surrounding objects; 3) with a

75-ohm cable used as feeder, the distance from the test generator should be increased by 20-30%; 4) all components of the feeder channel should be checked before testing and tuning the antenna; 5) dipoles of the same electrical length but with a uniform cross-section and with a stepwise varying one (constructed by joining tube segments of different diameters) have unequal geometrical lengths; 6) sleeves for joining the tube segments should be made of the same material as the tubes. Conclusion of the article will follow. Figures 1; tables 1.

[237-2415]

#### DOUBLE-LAYER TAPES: TO BE OR NOT TO BE

Moscow RADIO in Russian No 2, Feb 85 pp 25-26

SHKUT, V., NIKONOV, Ye. and NIKITINA, Ye., Shostka (Sumskaya Oblast)

[Abstract] Four IEC types of magnetic recording tapes are compared with regard to performance and marketability. Types I and II have one active layer, iron oxide with coercive force of 24-32 kA/m (R723DG) and chromium oxide or cobalt-coated iron oxide with coercive force of 34-57 kA/m (S4592A) respectively. Type 3 has two active layers of FeCr with 4-5 dB lower noise level and 3-4 dB higher signal level (CS301). Type 4 has one layer of metallic iron, Fe-Ni alloy, or Fe-Co alloy with coercive force of 63-80 kA/m. Despite their excellent characteristics, type 3 tapes are produced and used on a moderate scale only. This is explained by rapid developments and breakthroughs in the less costly single-layer tapes. Another reason is that double-layer tapes require a higher class of recording equipment with such extra features as frequency predistortion and a special switch for high-frequency magnetizing current. While double-layer FeCr tapes have not yet found sufficient acceptance on the consumer market, new and better single-layer tapes continue to appear, the latest being "Extra Efficiency" tapes. Tables 1; references: 9 Western.

[237-2415]

#### HIGH-QUALITY INTERMEDIATE-FREQUENCY AUDIO AMPLIFIER

Moscow RADIO in Russian No 2, Feb 85 pp 30-32

BOGDANOV, V. and PAVLOV, V., Leningrad

[Abstract] An intermediate-frequency (31.5 MHz) audio amplifier for the television sound track is described which operates according to the principle of two-channel reception, with the intermediate-frequency video amplifier in another channel. Separation of sound and image channels eliminates their mutual interference and allows optimizing the frequency characteristics of one without degrading those of the other. Its amplifier stage and limiter stage, each on two transistors, are connected in cascade and to a series

K174UR3 DAI microcircuit chip, followed by two 2-section bandpass filters with a 6 dB bandwidth of approximately 600 kHz each. Automatic frequency control is provided, by insertion of a varicap into the phase-shifting circuit of the detector in the DAI microcircuit chip. A printed-circuit board serves as chassis. The performance characteristics are: sensitivity 20  $\mu$ V at a 26 dB signal-to-noise ratio for predistortion correction at a 1 kHz modulation frequency and a  $\pm$  15 kHz frequency deviation, signal-to-noise ratio 64 dB at a 1 kHz modulation frequency and a  $\pm$  50 kHz frequency deviation of a 1 mV input signal, ripple factor 0.6%, and output voltage 250 mV at a  $\pm$  50 kHz frequency deviation. The amplifier requires a 12 V power supply and draws a current of 28 mA. Figures 4.

[237-2415]

#### FRAME-SWEEP MODULE 'GORIZONT Ts-257' WITH DEVICE FOR LEAD-DOWN OF BEAMS

Moscow RADIO in Russian No 2, Feb 85 pp 33-36

KRUL, Yu. and SADOVNICHIIY, V., Minsk

[Abstract] A frame-sweep module is described which operates with a sawtooth current in the vertical-deflection coils of kinescopes with 90° or 110° deflection angle. Its special feature is a 3-transistor generator of return-stroke pulses, which allows using a single-polarity voltage supply for the push-pull output stage and reduces the current drain. The module also contains a 2-transistor generator of beam-blanking pulses, a 2-transistor master oscillator, a 1-transistor emitter follower, and a 5-transistor 3-stage amplifier. To this module is added another one with devices for radial lead-down and centering of color beams, including a regulator for dynamic and static superposition of color beams on the screen with three electromagnets for lateral movement of the blue beam and compensation of the effect on already led-down red and yellow beams. The lead-down set is analogous in operation to a similar set in the line-sweep module. The regulator differs from the conventional one in UPIMTsT-61-11 television receivers by having line coils and frame coils separated, the former for lead-down of red and green horizontals and the latter for lead-down of red and green verticals. There are also separate circuits for frame lead-down and line lead-down of blue and yellow horizontals. The performance characteristics of the module are: maximum nonlinear distortion 8%, thermal instability of image height over the 100-900  $\mu$ A range of beam current not exceeding 3%, maximum duration of return stroke 0.95 ms, minimum amplitude of blanking pulse 10 V, frequency range of master oscillator 40-47 Hz. Figures 4; tables 1.

[237-2415]

## SOVIET TELEVISION TECHNOLOGY: IMMEDIATE GOALS AND OUTLOOK

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 3-7

PALITSKIY, V.M., deputy chief, Main Production-Engineering Management, State Committee at USSR Ministry of Television and Radio

[Abstract] A major overhaul of the USSR television broadcasting system, including its refurbishment with third-generation color television apparatus, has begun during the eleventh Five-Year Plan period and still continues. One important part of the overall program concerns construction and installation of broadcast producer's equipment. The main trend here is development and commercial production of studio equipment and mobile equipment with digital coding of signals, a high priority having been assigned to video taping equipment. In setting up immediate goals and assessing the outlook for successful completion of this overhaul, it is useful to draw on experience gained and result obtained in connection with the recent Moscow Olympics as well as on CCIR recommendations and SECAM system performance characteristics. Development of color projecting apparatus should be completed by 1986. At the same time, fourth-generation color television apparatus should also begin to be developed according to schedule.

[268-2415]

UDC 778.53-182.3

## EQUIPMENT SET FOR FILM SHOOTING FROM MOBILE BASES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 8-10

BABENKO, V. A., Moscow Design Office for Motion-Picture Equipment, MELAMED, Yu.I., Scientific Research Institute of Motion Pictures and Photography, KOZLOV, V.V. and FATEYEV, V.V., Moscow Higher Technical School imeni N.E. Bauman

[Abstract] An equipment set for film shooting from mobile bases such as aircraft, watercraft, or automobiles with means of ensuring a steady picture has been developed jointly by the Moscow Design Office for Motion-Picture Equipment, the Scientific Research Institute of Motion Pictures and Photography, and the Moscow Higher Technical School. It features long-focus optics and a gyrostabilized platform with a protective tracking nose cone. The equipment this platform includes a 1KSR-2M photographic movie camera with a 120 m long film cartridge and an 18EP-16APK synchronous electric drive motor, a 350PF15 variable-focus objective with "range"--"reduction"--"stop" control, and a parallax-free viewer with an LDH-26 transmitter camera (US) and a T14BC9A monitor (FRG). The platform is mounted on a universal joint providing three degrees of freedom. The stabilization system consists of a small controlled 3-stage gyroscope and an indicating device in each of the three coordinate channels, a flywheel as an inertial reference element and an unloading device in each transverse channel for compensation of insufficient structural stiffness of the drive and its low-frequency damper. This stabilizer is driven by a gearless d.c. electric motor delivering a maximum

torque of 300 N·cm. The scanning speed about each of the three principal axes (longitudinal, transverse, normal) is automatically regulated by adjustable voltage dividers whose movable parts have been kinematically coupled to the corresponding drives of the variable-focus objective. The control system also provides for soft and smooth starting of the gyrostabilizer. An experimental prototype of this equipment set was successfully tested on an MI-8 helicopter, on a bus, and on a barge. The equipment set was found to be versatile enough to provide the film producer with means necessary to get the best possible angles. Figures 4; tables 1; references: 3 Russian. [268-2415]

UDC 778.968:681.84:083.84

#### EXPERIMENTALLY DETERMINED CHARACTERISTICS OF THERMOCOPYING PROCESS FOR REPRODUCTION OF MAGNETIC RECORDINGS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 34-36

PAVLOV, A.Yu.

[Abstract] The methods of transferring magnetically recorded data from the original tape onto a duplicate one by the thermocopying process were studied experimentally, for the purpose of their comparative evaluation. In the dynamic method both tapes are wound and thus moving while they make contact along a short arc segment under a heater, pressed against each other by a pair of rollers and cooled beyond the contact area by other rollers along the winding path. In the static method both tapes remain stationary while in contact with each other over their entire length, inside a thermostatic chamber. In both cases the tapes are heated so as to raise the temperature of their active layers to their Curie point or slightly higher, with minimum possible deformation of the substrates. In the experiment a small quartz lamp with a reflecting and concentrating mirror behind was used for contactless radiative heating so as to eliminate thermal wear of the tapes. As originals were used tapes with active layers of  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> or CrO<sub>2</sub> powder, as duplicates were used tapes with either LPR35CR-grade or CV26R-grade (BASF) CrO<sub>2</sub> powder. First was measured the duplicate recording level as function of the original recording level. Then was measured the ratio of original recording level to duplicate recording level as function of the frequency over the 0-16 kHz range in the dynamic mode and in the static mode. Distortion of the tape substrates was estimated visually and from high-frequency test recordings of a short-wave (9.5  $\mu$ m) signal. The results of this experiment are compared with theoretical calculations for a 11  $\mu$ m thick layer of LPR35CR powder and a 4  $\mu$ m thick layer of CV26R powder, on the basis of known magnetization characteristics of the two CrO<sub>2</sub> powders and temperature dependence of their magnetic permeability. Static thermocopying was found to deform the tape substrates so as to lower the duplicate recording level much more appreciably than dynamic thermocopying, but this could be corrected by some adjustment of the reproducing head. Figures 7; references 6: 4 Russian, 2 Western. [268-2415]

'OKTAVA' MOBILE TELEVISION STATION WITH VIDEO TAPING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 37-39

SKURENKO, A.V., REZNICHENKO, V.I., GETMAN, V.G., SHAGANOV, N.N. and PROTSENKO, N.I., Special Design Office, Kirovograd Radio Products Manufacturing Plant

[Abstract] The "Oktava" mobile television station is intended for oblast-wide coverage, unlike the "Magnoliya" and "Etyud" mobile television stations for republic-wide or nationwide coverage. Its complete third-generation "Perspektiva Tsvetnaya Televiziya" color television equipment, updated for this mode of operation, includes two KT-132 cameras and two external sources for producing television programs. It makes possible correcting signals of two external programs transmitted over a 500 m long RK-75-4-37 cable, precorrecting signals from a "Kadr-3PM" video tape recorder transmitted over a 250 m long RK-75-4-37 cable, and recording as well as playback of images and sound track. The synchronization system provides for three modes of operation: autonomous with a signal from the station's own high-stability quartz oscillator, driven by an external complete color television signal, with automatic transfer to autonomous operation in case of loss of that signal, and in synchronism with a driving SSTs-2 signal from a satellite communication center directly or through another "Oktava" mobile station. The equipment includes furthermore a television producer's panel with high-speed switches and action control, special effects, emergency transfer to standby facilities, color monitor, and remote control of the "Kadr-3PM" video tape recorder on the main bus. The auxiliary bus carries in three separate compartments a diesel-generator set, racks and shelves with power and auxiliary equipment, and air-conditioned facilities for a crew of six, including two drivers. There is regular and emergency lighting on each bus, there are fire extinguishers, and there is telephone connection. Both buses and the television equipment have been designed for operation at outdoor temperatures ranging from -40°C to +40°C, except the KT-132 cameras rated for -30-(+40)°C only. Figures 4. [268-2415]

AUTOMATIC MANAGEMENT SYSTEM FOR TELEVISION BROADCASTING COMPLEX

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 55-58

GORIZONTOV, A.M., Leningrad Institute of Electrical Communications Engineering imeni M.A. Bonch-Bruyevich

[Abstract] The main purposes of automating the management of a television broadcasting complex are to ensure consistent responsiveness to unforeseen events, to put in order and simplify the television program planning process,

and to make more effective use of costly television equipment. Automatic management of television broadcasting can be treated as automatic management of an enterprise, generally, with the specific characteristics of a television broadcasting complex taken into account. The automatic management system will in this case have a 5-level structure. At the first, lowest, level is automatic regulation of television signal parameters and thus control of the signal sources. At the second level is programmed control of the televised object and of the appropriate communication channel equipment. At the third level is control of the technological process involved in television program production and broadcasting. At the fourth level is management of the television broadcasting station-enterprise. At the fifth, highest, level is management of the television network. Design analysis and subsequent performance evaluation of such an automatic management system, especially of its fourth level, must be based on five criteria: 1) cost effectiveness; 2) centralization of responsibility and accountability with active involvement of top manager; 3) innovation in tackling heretofore unsolved problems and in furthering the scope of services; 4) standardization and classification of problem solutions for adaptability to wide range of operating conditions; 5) flexibility for accommodation to new conditions in the future. Implementation of these criteria requires technical and economic planning, management of the basic television program production, management of preparatory operations, management of auxiliary operations, and quality control--each constituting a separate subsystem. The software for such an automatic management system must include a data base, classification and coding of all relevant data, a data processing logic based on documentation analysis, optimization of this logic with elimination of delays and duplication, and computer-aided optimum documentation handling. The mathematical model and necessary software for management of the basic program production process have already been developed at the Leningrad Institute of Electrical Communications Engineering and the All-Union Scientific Research Institute : Television and Radio Broadcasting.

References: 10 Russian.

[268-2415]

UDC 778.533.6-83-531.6

#### CONTROL MODULE FOR ELECTRIC DRIVE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 2, Feb 85 pp 59-60

PRYADKO, A.M., Motion-Picture Studio imeni A.P. Dovzhenko

[Abstract] Various control modules have been developed for regulating the speed of the newest small and reliable high-performance electric drives, essential components of any film shooting set. The control module for a 5BD-16APK drive, also suitable for a 2EP16APK drive and a 15EPSS standby drive, includes a stabililtron, four transistor stages, seven resistors, a power-supply battery with protective fuse and a toggle switch between two connectors across the circuit. It is connected between the DPM-20 d.c. motor of the 5BD-16APK drive and a tachometer generator sitting on the motor

shaft. Maximally fast response of the control module is attained by omission of an RC filter in the feedback loop, it also stabilizes the motor speed within 0.5% - at a constant supply voltage. The module was tested on a simulator of peak loads in "Konvas-Avtomat" film shooting sets. Figures 4; references: 1 Russian.

[268-2415]

## TELEVISION TECHNOLOGY OF THE FUTURE

Moscow TEKHNIKA KINO I TELEVIDIENIYA in Russian No 2, Feb 85 pp 77-78

CHIRKOV, L.Ye., deputy chief editor

[Abstract] Development of the technological base for television broadcasting in the 1984-90 period, in accordance with resolutions of the Central Committee at the USSR Council of Ministers, was discussed at an All-Union conference held in November 1984 in Lvov with the Industrial Association "Elektron" acting as host. In the conference participated the A.S. Popov Soviety of Radio Engineering, Electronics and Communications, central board as well as Ukrainian-republic and Lvov-oblast boards of its scientific-technical department, also by the USSR State Telegraph Office, USSR Ministries of Communication, Communication Equipment Industry, Electronic Equipment Industry, and by the USSR Academy of Sciences - altogether over 300 specialists from over 30 cities. The topics of two plenary meetings and six section meetings included outlook for improvement of television broadcasting, analog-digital hybrid stage of television broadcasting development process, hardware availability assurance, television theory and engineering, improvement of image quality and development of television measuring techniques, signal detectors and transducers, television station and transmission equipment, including satellite channels, and problems of expanding the use of television in scientific research and industrial processes. New equipment was displayed during the conference, including television receiver sets as well as kinescopes and various instruments. Most interest attracted the commercially produced color television sets "Elektron-Ts380D" (51 cm screen), "Elektron-Ts280D" (61 cm screen), and "Elektron-Ts265D" (67 cm screen) - all much more energy efficient than existing sets. The "Elektron-Ts265DL" model (67 cm screen) includes a service system, wireless remote control, a timer, and a built-in video games module.

[268-2415]

## INSTRUMENTATION & MEASUREMENTS

UDC 62.523

### ADAPTIVE ALGORITHM FOR SELECTING DOMINANT VARIABLES OF NONLINEAR OBJECTS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 10 Oct 84) pp 15-18

TYUMIKOV, D.K. and KATSYUBA, O. A., Kuybyshev Polytechnical Institute imeni V. V. Kuybyshev

[Abstract] A two-phase approach is proposed for determining the dominant (the central) input variables of nonlinear static objects of control. In the first stage, an iterative procedure is used to identify the paired dispersion ratios, which represent the characteristics of the nonlinear statistical connections between the input and output variables, and which are used as weights for selecting the dominant variables. In the second stage, a criterion described elsewhere by the author is used to define the set of dominant variables, the number of which contains most of the information about the output variable. A numerical example is presented. Figures 2. References: 3 Russian.  
[296-6900]

UDC 681.586'37.073

### INFORMATION-MEASURING INSTRUMENTS WITH TEST CIRCUITS FOR TEMPERATURE MEASUREMENT

Moscow IZMERENIYA KONTROL AVTOMATIZATSIYA in Russian No 3, Mar 85 pp 14-21

KULIKOVSKIY, K. L., doctor of technical sciences, and KUPER, V. Ya., candidate of technical sciences

[Abstract] Information-measuring instruments with test circuits and test algorithms are recommended on account of the possibility of attaining high accuracy and stability as well as high interference immunity of measurements. The concept is applicable to temperature measurement, in which case the test circuit and test method depend largely on the temperature range. Temperature test methods are feasible, with chemically pure substances having known and

stable phase transition points as reference markers. Semiconductor devices for temperature-to-(electrical) resistance conversion are highly sensitive and thus most suitable as transducers, but are commercially produced without standardization of their metrological characteristics and, therefore, require correction for use over the entire temperature range - usually on the basis of their static current-voltage characteristic and particularly its extremum point. Another approach is using resistance test circuits, with thermistors and plain resistors switchable individually or through a commutator before the instrument transducer which gives either an analog reading or, after conversion, a digital one. Possible wideband resistance test circuits are: two thermistors in parallel and a plain resistor in series with them for generating additive or multiplicative test signals; two thermistors and a plain resistor all in series across a commutator for polynomial approximation of the thermometer transfer function; one thermistor with a plain resistor in parallel and a plain resistor in series for generating various test functions; one thermistor with a plain resistor in series and a plain resistor across both for simplified computation of thermistor resistance; one thermistor in series with a plain resistor connected to either of two current generators for change of current magnitude or reversal of current direction, or connected to either terminal of a voltage generator for reversal of signal voltage polarity. Possible narrow-band test circuits are a bridge with a thermistor in one arm and plain resistors in the other three; a thermistor with two diodes and a plain resistor with two diodes in parallel across either of two current generators. Figures 10; references: 9 Russian.

[273-2415]

UDC 681.11:(681.325.5:621.3.049.77)

#### HARDWARE AND SOFTWARE FOR TIME MEASUREMENT WITH MICROPROCESSOR CONTROL

Moscow IZMERENIYA KONTROL AVTOMATIZATSIYA in Russian No 3, Mar 85 pp 30-42

SHPOLYANSKIY, V.A., doctor of technical sciences

[Abstract] The principle of time measurement by continuous counting of strokes and reproducing a discrete time scale in the form  $t(t) = t_0 + \tau_i$  entier( $t/\tau_i$ ) has been adapted to and incorporated in digital and analog chronometers with microprocessor control. They are driven by a stepper motor, with the algorithm of their operation programmed in a microprocessor with either a direct-access memory only or with both direct-access and read-only memories depending on the degree of chronometer complexity. The most important and advance components of these chronometers are a programmable time relay and hardware for execution of time-related instructions. Still more effective use of a microprocessor is made in secondary quartz chronometers, with appropriate hardware and software modification or expansion, as for automatic dial setting and correction against primary time standards, date indication, alarm, and other features. Leaders in development and production of microprocessor-controlled clocks and watches are manufacturers in the United States (Hewlett-Packard, Intel, RCA), in Japan (Hitachi, National,

Oki Electric, Seiko, Sharp), in Switzerland (Ebauches, Faselec), in France (Cetehor), in Great Britain (AMI), and in West Germany (Eurosil). Figures 9; tables 2; references: 10 Western.  
[273-2415]

UDC 621.313.13-133.32

## ELECTRIC SYNCHRONOUS AND STEPPER MOTORS FOR DRIVING ELECTRIC CHRONOMETERS AND OTHER DEVICES

Moscow IZMERENIYA KONTROL AVTOMATIZATSIIA in Russian No 3, Mar 85 pp 43-52

KRASNOPEVTSEV, A.I., candidate of technical sciences

[Abstract] Electric synchronous and stepper motors for electric chronometers must satisfy five severe requirements: long life, low power drain, simplicity of design and manufacture, low cost, and small size. The conventional construction at the present time is a stator winding on an integral magnet core with one or three pole pairs magnetically driving and positioning the rotor, the latter usually made of an Al-Ni-Co alloy or a ferrite material. Motors with this basic construction are now mass produced. Several new constructions have been recently invented and developed in the Soviet Union. They have either one of the following three novel features or combine them: 1) split rotor structure with two or three salient-pole disks mounted on parallel shafts kinematically linkable to the single output shaft; 2) salient-pole permanent-magnetic stator with magnetic flux paths closing through low-inertia toothed rotor made of soft magnetic material, with the magnetic flux almost independent of the rotor position relative to the stator poles; 3) concentrated control winding on a ferromagnetic core sending a magnetic flux through the rotor in addition to the magnetic flux sent through the rotor by the permanent-magnet stator. Stepper motors with these features include inductor motors with various modifications such as hollow cylindrical magnets or coaxially split control winding, and motors with additional performance features such as reversibility or stepwise change of step for multispeed (2-speed) operation. Modifications of the basic 3-phase synchronous motor are such motors with two or three control windings, with two or three rotors shifted by half or third stator pole pitch respectively and kinematically coupled for uniform smooth motion, and several variants of a synchronous repulsion motor. A high-efficiency 18° stepper motor with permanent-magnet rotor, developed at the Scientific Research Institute of Clock and Watch Industry, is particularly promising and competitive for use in chronometers. Figures 6; tables 1; references 37: 20 Russian (16 USSR patent disclosures), 17 Western.  
[273-2415]

## SYNCHRONOUS DETECTORS IN SELECTIVE MEASURING INSTRUMENTS

Moscow IZMERENIYA KONTROL AVTOMATIZATSIYA in Russian No 3, Mar 85 pp 53-61

RYBIN, Yu.K., candidate of technical sciences, and BUDEYKIN, V.P., engineer

[Abstract] Linear selective conversion of the output signal for measurement, spectrum analysis, or other purposes involves multiplication by a weight function and subsequent integration. This is done either by tuned filters with an aperiodic weight function  $h(t) = e^{-\alpha t} \sin \omega_0 t$  ( $t$  - time,  $\omega_0$ -nominal frequency,  $\alpha$ -attenuation coefficient) or by synchronous detectors with a periodic weight function. Such a detector is essentially an analog multiplier with an integrator or low-pass filter, its weight function being generated from the reference signal. Existing synchronous detectors are of two types, harmonic and relay-type. Harmonic synchronous detectors are built on the basis of either field-effect transistors with controllable source-drain impedance or differential transistor amplifiers, with a strong trend toward circuit integration. Their drawbacks are narrow dynamic range, small scale factor, instability and nonlinearity of the transfer ratio, and dependence of the output voltage on the reference signal level. Relay-type synchronous detectors feature a wide dynamic range, a stable and linear transfer ratio, and simplicity of construction including that of the reference signal source. They are built on the basis of operational amplifiers with a set of switches in various more or less intricate circuit configurations. They are designed according to either of three principles: 1) field-effect transistor between a voltage source and a high-impedance load; 2) field-effect transistor between a current source and a low-impedance load; 3) field-effect transistor in the negative-feedback loop of the operational amplifier. Their drawback is a narrow frequency range, owing to a not yet adequately explained parasitic pickup of the reference voltage by the signal circuit. However, their selectivity can be enhanced by use of special weight functions. Most effective is a staircase weight function generated by an array of auxiliary synchronous detectors with output voltages shifted in phase from one another. A less effective other method is generating the weight function from a sinusoidal voltage by conversion of the latter into a sequence of constant-amplitude variable-duration pulses. Leaders in development and production of synchronous detectors are manufacturers in the United States (PAR, Kelthley Instruments), in Great Britain (Brookdeal Electronics), and in Austria (ITHACO). Figures 8; tables 1; references 45: 30 Russian (2 USSR patent disclosures), 15 Western (1 in Russian translation).

[273-2415]

PRINCIPLES OF DESIGNING DIGITAL FREQUENCY SYNTHESIZERS

Moscow IZMERENIYA KONTROL AVTOMATIZATSIYA in Russian No 3, Mar 85 pp 62-68

KRYUKOV, V.I., engineer

[Abstract] The principal component of digital frequency synthesizers is a frequency-signal shaper, preceded by a clock generator and followed by a filter for elimination of harmonics. There exist six types of frequency-signal shapers, designed respectively: 1) on the basis of a frequency divider with a controlled variable-divisor stage and a fixed-divisor stage feeding the output digital-to-analog converter; 2) with two memories and two frequency selectors, an adder with a register and another register feeding the output digital-to-analog converter; 3) on the basis of an oscillator with phase-lock automatic frequency control; 4) with Fourier series expansion; 5) with Walsh functions; 6) on the basis of a photomultiplier dividing the input frequency by a fractional number, with binary frequency dividers for frequency stabilization. Frequency synthesis with a low-frequency clock generator feeding a frequency-signal shaper of the first type is possible and economically achievable by means of feedback from the fixed-divisor stage to the variable-divisor stage. Figures 7; references 29: 22 Russian (1 USSR patent disclosure), 7 Western.

[273-2415]

METROLOGICAL CHARACTERISTICS OF HIGH-FREQUENCY PHASE MEMORY USING TUNED AMPLIFIER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 11 Jun 84) pp 87-91

LATENKO, V. I., senior engineer, NIZHENSKIY, A.D., doctor of technical sciences, director of laboratory, and ORNATSKIY, I.A., senior engineer, Institute of Electrodynamics, UkrSSR Academy of Sciences, Kiev

[Abstract] The performance characteristics of a high-precision phase-to-code converter for use in laser-type range finders operating by the pulse-phase method are analyzed and evaluated, particularly in the more difficult case of short probing signals. The probing light signal from a solid-state laser is intensity modulated by a voltage signal from a quartz oscillator, after that signal has passed first through a frequency multiplier and then through a tuned power amplifier. The modulating signal is also transmitted to a mixer, where it combines with the signal from a heterodyne oscillator into a difference-frequency reference signal for the radio-pulse phase meter. The light signal reflected by the target returns to a photoreceiver for conversion into a voltage signal which is transmitted to a second tuned amplifier, this

one with a high Q-factor serving as phase memory. The output signal of the latter combines in a second mixer with the same heterodyne oscillator signal into another difference-frequency signal fed to the phase meter for comparison with the reference signal. With the first amplifier operating in class B, the error of phase measurement caused by the non-informative "residual" first-harmonic voltage in the signal from the quartz oscillator has two components, both appearing as quadrature voltages at fundamental frequency. Both are evaluated, one originating in the first amplifier and one originating in the frequency multiplier. Numerical data are given for a range finder using a Q-switched laser which emits probing pulses of 10-30 ns duration, a tuned amplifier with  $Q=10$  for the modulator and a tuned amplifier with  $Q=150$  as phase memory. Figures 2; references: 8 Russian.

[270-2415]

UDC 621.373.42

#### PROBABILISTIC CHARACTERISTICS OF RIPPLE FACTOR IN SYNTHESIZED QUASI-SINUSOIDAL SIGNALS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 21 Nov 83) pp 102-105

SKRIPNIK, Yu. A., doctor of technical sciences, department head, Kiev Technological Institute of Light Industry, GRIGORYAN, R. L., candidate of technical sciences, department head, and MASLOV, N. V., senior engineer, Krasnodar Design Office for Radio Equipment, RUGALENKO, Yu. V., senior engineer, Krasnodar

[Abstract] A most important characteristic of continuous quasi-sinusoidal step signals synthesized by high-precision digital generators is their ripple factor, which not only measures the signal distortion but also determines the size of such generators. The ripple factor depends on the number of discretization steps along the time (abscissas) axis and the random error of quantization levels along the sine (ordinates) axis, both in turn depending on the parameters of the analog-to-digital converter. The ripple factor therefore is a probabilistic quantity to which the Parseval theorem can be applied. It is accordingly as

$$r = \sqrt{\frac{S - Z}{a_1^2 + b_1^2}} - 1 \quad (S = \frac{1}{2}a_0^2 + \sum_{n=1}^{\infty} (a_n^2 + b_n^2), \quad Z = \frac{1}{2}a_0^2). \quad \text{The mathematical expectations}$$

and the dispersion of all four parameters in this expression are evaluated, for the mathematical expectation and the dispersion of the ripple factor. The minimum value of the ripple factor can also be determined on this basis, depending on the number of digits and the corresponding distribution of rounding error. References 5: 4 Russian, 1 Western (East or West German).  
[270-2415]

## TRANSPORTATION

UDC 621.314.572

### DESIGN OPTIMIZATION OF TRACTION FREQUENCY CONVERTER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 7 Mar 84) pp 29-34

PIVNYAK, G.G., doctor of technical sciences, dean, and VYPANASENKO, S.I., candidate of technical sciences, senior scientific associate, Dnepropetrovsk Institute of Mining

[Abstract] Design optimization of autonomous inverting frequency converters for contactless electrical vehicular transportation is considered, most important being high efficiency along with frequency and current stability over a wide range of load variation. Frequency conversion proceeds in two stages, rectification of the 50 Hz current being followed by inversion to a higher frequency - up to 5 kHz when a resonance-type inverter with frequency doubling and with a clipping diode is used. Optimization of such an inverter involves minimizing the rather large installed thyristor power, more appropriately in relative terms the ratio of thyristor power to load power than in absolute terms, maximizing the ratio of choke current to rectifier output current under minimum load resistance, and maximizing the ratio of fundamental component in the inverter load current to average input current to the thyristor bridge. Optimization of the TPCh-250-5 traction frequency converter produced at the Tallinn Electrical Equipment Manufacturing Plant according to these three criteria has improved its power factor by 40%, on the average, and thus allowed reducing the nominal power rating of the TSShVP mobile transformer substation for mine pits from 400 to 250 kVA. Figures 3; references: 7 Russian.

[270-2415]

MAGNETS

UDC 518.61:517.946

A DIFFERENCE SCHEME FOR NONLINEAR EQUATIONS DESCRIBING FERROMAGNET ALTERNATING MAGNETIZATION

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-MATEMATYCHNYKH NAVUK in Russian No 2, Feb 85 (manuscript received 15 Jul 83) pp 21-23

KNYAZEV, M. A., SHKEL, V. A., Institute of Applied Physics, Belorussian SSR Academy of Sciences; Institute of Mathematics, Belorussian Academy of Sciences

[Abstract] A difference scheme is obtained for the problem of the alternating magnetization of an infinitely long ferromagnetic cylinder with radius R made of material with constant electrical conductivity. Making allowance for magnetic hysteresis, the scheme provides good results for wide frequency spacing. The proposed approach is found to provide better results than previous schemes. References: 6 Russian.

[281-6900]

UDC 621.318.4:621.314.2

ELECTROMAGNETIC DEVICES WITH OPTIMUM AND PLANAR GEOMETRIES OF MAGNET STRUCTURE

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 1, Jan-Feb 85 (manuscript received 14 Jun 84) pp 47-52

LOBANOVA, T.P., senior laboratory technician, and SHIROKOV, V.L., candidate of technical sciences, docent, Leningrad Institute of Aircraft Instrument Design

[Abstract] A procedure for optimizing the design of electromagnetic devices such as transformers is outlined, minimum volume and cost of active materials (iron, copper) being the usual optimality criterion. Into consideration is taken the fact that in the structure of such devices the volume of coil heads can become equal to or exceed the volume of useful material and upon impregnation assume a nearly cubic shape. The optimum geometrical proportions are

derived here for a shell-type structure with  or  core. Here length of the magnetic path is the principal dimension which determines the volume, width and height of the window being of secondary significance. The procedure is extended to core-type structures , ,  as well as to ferrite cores with planar structure (single-layer array of adjacent core elements) for maximum cooling surface allowing higher current density and thus yielding better copper economy - an important consideration in high-frequency microelectronic circuitry. As measure of planarity is regarded the ratio of base area to height. This ratio is 1 for cubic structures, 0.5-1.5 for conventional structures, 1-3 for optimum structures, and 3-10 for planar structures. A ratio higher than 10 is inefficacious and uneconomical. Figures 4; tables 2; references: 5 Russian.

[270-2415]

## ELECTRON DEVICES

### SCALE AND MNEMONIC DISPLAYS

Moscow RADIO in Russian No 4, Apr 85 pp 60-61

LISITSYN, B.

[Abstract] The P-424 six-digit digital magnetic tape recorder tape counter is described. The environmental conditions under which the device can be operated are tabulated. The counter is ready to operate within 2.5 seconds of turning on the power in most instruments. The display is 72 cm wide, 31.5 cm high exclusive of leads, and 11 cm deep. Installation recommendations are provided. Figures 2.

[290-6900]

### VISUAL/AUDIBLE READOUT PROBE

Moscow RADIO in Russian No 4, Apr 85 pp 36-38

POTAPENKO, O.

[Abstract] A probe is described for monitoring the operation of digital equipment employing TTL microcircuits. The probe indicates logic 0 and 1 levels visually and audibly, and makes it possible to determine the presence of single pulses (at least 30 nsec long), as well as pulse sequences, and to estimate relative pulse duration. The logic zero level is indicated by a zero displayed visually accompanied by a low tone, and a one is indicated by a displayed one and a high tone; pulses are indicated by blinking of the display and a signal that alternates every 100 msec. The probe incorporates an extendable needle and an alligator clip, as well as a volume control. The schematic diagram of the probe is presented and explained, and detailed drawings of the probe are provided. Figures 2.

[290-6900]

## DIGITAL SCALE ASSEMBLY

Moscow RADIO in Russian No 4, Apr 85 p 24

VASILYEV, V.

[Abstract] An automatic digital scale assembly is described that incorporates three integrated circuits, one transistor, and a relay. The device consists of a frequency channel selector that is controlled by pulses coming from a counter, auxiliary count mode control circuits, a "store" pulse generator, and a reset pulse generator. The logic diagram of the device is presented and explained. Figures 1. References: 2 Russian.  
[290-6900]

## TIMING RELAY

Moscow RADIO in Russian No 4, Apr 85 pp 25-27

SHESTAKOV, A.

[Abstract] A timing relay is described for controlling the lamp of a photographic enlarger to provide an established exposure time for photographic printing. Timing relays based on digital counting provide highly stable timing performance. The proposed device displays the time-out digitally, allowing the exposure to be read in the dark. The structural diagram of the relay is presented and explained, and full-size board layouts and foil patterns are given. Figures 3.  
[290-6900]

UDC 621.375.127

## CLASS D PUSH-PULL THYRISTOR AMPLIFIER

Kiev UZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 28, No 3, Mar 85 (manuscript received 15 May 84) pp 85-86

MIGULIN, I.N., UVAROV, R.V., AKIMOV, A.N., AFANASYEV, P.V., and KONDRAZHEN, O.V.

[Abstract] A method is proposed for construction of a Class D amplifier in which thyristors are used as active devices. The method is based on conversion of the voltage of a primary power source (e.g., an industrial network) into high-frequency voltage of meander form with subsequent pulse-width control of it according to the change of signal law, subject to intensification. An experiment confirmed the possibility of constructing a powerful key (klyuchevoy) amplifier using contemporary types of thyristors. In addition to the high energy indices of the amplifier, economy of expensive copper

winding is assured because of the absence of a power transformer operating at the network frequency. The amplifier can find wide use in intensification (forming) of low-frequency electrical oscillations with large output power. In the indicated range of operating frequency the proposed amplifier can replace with success analogous devices based on transistors. Figures 2. [267-6415]

UDC 537.533.3.01

SOLUTIONS TO EQUATIONS OF STEADY BEAM INVARIANT WITH RESPECT TO TRANSFORMATIONS CONTAINING ARBITRARY TIME FUNCTIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 5 May 83) pp 367-372

SYROVOY, V.A.

[Abstract] Specialization of the arbitrary time functions in transformations which retain the equations of a steady nonrelativistic particle beam in a uniform magnetic field has been found to yield solutions which describe steady flow. These solutions are now analyzed first for flow linearly solenoidal in a transverse plane, for which solution of the corresponding equations reduces to integration of linear equations with constant coefficients, and then for the more general case of flow potential in a transverse plane. When they describe steady flow with velocity components which are additively separable linear functions of the space coordinates, they are shown to be invariant with respect to transformations containing arbitrary exponential time functions. This is shown for combinations of ranges and values of parameters where such solutions exist, also for the specific case of flow with hyperbolic particle trajectories. References 7: 2 Russian, 5 Western.  
[220-2415]

UDC (621.37/39:534)001.5.27

THEORETICAL AND EXPERIMENTAL STUDY OF TEMPERATURE CHARACTERISTICS OF DEVICES WITH SUPERFICIAL VOLUME ACOUSTIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 28 Mar 83) pp 373-377

ZASLAVSKIY, A.M., MEZHUYEV, D.I., SEMENOV, E.A. and SUCHKOV, S.G.

[Abstract] An important consideration in the design of SVAW devices such as interdigital transducers and filters is finding crystal cuts characterized by high thermal stability. A method of theoretically calculating their temperature, energy, and phase characteristics is proposed which will yield satisfactory agreement with experimental data. It is based on simple

relations for the temperature coefficient of time delay or frequency  $TCD = -TCF = \alpha - \frac{1}{v} \frac{\partial v}{\partial T}$  over a narrow temperature range ( $v$  - phase velocity of acoustic waves,  $\alpha$  - coefficient of thermal expansion,  $T$  - temperature) and the thermal frequency deviation  $\frac{\Delta f}{f} = \frac{f(T) - f(T_0)}{f(T_0)}$  over a wide temperature

range ( $T_0$  - nominal ambient temperature). Calculations according to this method agree with measurements of the thermal frequency instability of an SShVAW (shear waves) delay line in the feedback loop of an oscillator. They confirm the experimentally established temperature dependence of the frequency, which for quartz crystals cut in the  $Y +41^\circ$  direction is linear in the case of an ST-cut (SAW device) and parabolic in the case of a BT-cut (VAW device). On the basis of this method, it is possible to find the most thermally stable cuts for such devices. Figures 3; tables 1; references 6: 3 Russian, 3 Western.

[220-2415]

UDC (681.785.554:534)001.24

#### OPTIMIZATION OF ACOUSTOOPTICAL SPECTROMETERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 9 Mar 83) pp 378-386

ANANYEV, Ye.G., VIZEN, F.L. and PUSTOVYOT, V.I.

[Abstract] The output signal-to-noise ratio of acoustooptical spectrometers, instruments based on anisotropic Bragg diffraction and including a collinear tunable filter with the piezoelectric transducer, is calculated and its dependence on the spectrometer parameters is evaluated for the purpose of accuracy optimization. The acoustic output power and the efficiency of the transducer feeding a photomultiplier receiver through the filter are evaluated in the process, whereupon the geometrical dimensions of transducer and filter are adjusted for maximum efficiency at a fixed power level. While the dimensions are varied, 100% efficiency requires that the ratio of transducer diameter to filter length be held constant. The signal-to-noise ratio is found to depend on three parameters. It depends on the duty factor of the square pulse signal which modulates the microwave power signal, a duty factor of  $\frac{1}{2}$  being the optimum. It depends on the spectral sensitivity of the optical receiving device and thus on the wavelength to which the filter is tuned, this nonuniformity being minimizable by a transducer with the proper resonance frequency. It depends on the length of the filter, at constant ratio of transducer diameter to filter length, there being an optimum filter length which maximized the signal-to-noise ratio. Increasing the ratio of transducer diameter to filter length and thus the acoustic power makes the optimum filter length smaller, which improves both the material economy and the measurement accuracy, limited by the maximum allowable electric power in the transducer and the desirable resolving power of the filter. The analytical relations have been applied to a spectrometer with an FEU-69A photomultiplier, a filter having a bandwidth of 300 nm when

tuned to the 0.8  $\mu$ m wavelength, and a Cd-film transducer. Figures 4; references 6: 3 Russian, 3 Western (1 in Russian translation).  
[220-2415]

UDC 621.383

#### NOISE PARAMETERS OF OPTOELECTRONIC DECOUPLERS

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 27 Apr 1985) pp 73-76

NOSOV, Yu. R. and MAMEDOV, A.K.

[Abstract] The most important performance figures of optoelectronic decouplers are the noise factor, the signal-to-noise factor, and the threshold of sensitivity. This paper studies the noise parameters of an optoelectronic decoupler with a differential optron, which at present is most promising. Analytical relationships are obtained for determining the noise coefficient, the noise power, the signal-to-noise ratio, and the threshold of sensitivity of an optoelectronic decoupler. Figures 2; references 6: 5 Russian, 1 Western.  
[257:6415]

#### TODAY AND TOMORROW OF SOLID-STATE WATCHES

Moscow RADIO in Russian No 3, Mar 85 pp 22-23

BOBKOV, V. and MALASHKEVICH, A.

[Abstract] The functional possibilities are described of solid state wrist watches (elektronnye chasy), both series-produced and those being mastered. The characteristics of a number of series and newly mastered models are listed in a table, and photographs of five models are shown. A discussion is given of watches "in general" and watches "in particular", which includes proposed future developments. Figures 5, tables 1.  
[255:6415]

#### CABLE TESTER

Moscow RADIO in Russian No 3, Mar 85 pp 24-25

DROBNITSA, N., Zaporozhye

[Abstract] During assembly and repair of multiline cables much time is expended in the search for conductors required for various purposes. Specialized cable testers are used to reduce the amount of this work. A

new device for this purpose is described in detail (with two wiring diagrams) which is simpler to manufacture, assemble, and use. It is noted that if the number of closed conductors in the cable is greater than five, there is found to be strongly stressed outlet keys of the control unit, connected to the conductors in large numbers. Figures 3.

[255:6415]

UDC 621.372.8.049.75.001.75

MATHEMATICAL MODELS OF CAPACITIVE IRREGULARITIES IN STRIPLINES. COMPARISON OF VARIOUS ANALYTICAL METHODS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 7 Feb 83) pp 639-646

BOGACHEVA, L.V., BUDEKOV, Yu.B., KRASIKOVA, O. A., MAKHALIN, V. N. and OTMAKHOV, Yu. A.

[Abstract] The characteristics of capacitive irregularities in striplines are found by solving an integral equation of the first kind to find the charge distribution density on the metal conductors. Because the problem is ill-posed, and the Green function characterizing the systems is complex, it is difficult to solve that integral equation. Different methods for solving the problem are specified and compared in terms of accuracy, analytical method, etc., and tested experimentally. Three methods for solving the subject integral equation are analyzed: the regularization method, the projection method, and the method in which the singularity in the charge distribution density is isolated. FORTRAN programs for the BESM-6 computer are described for calculating the capacitance characteristics of complex irregularities in striplines consisting of  $n$  rectangular regions. The analytical and experimental data agree to within the measurement error for  $n \leq 12$ , and to within approximately 20% for  $n \geq 20$ . The calculation time for the regularization method depends upon the number of integration points and the initial approximation of the regularization parameters. The calculation time for the singularity-isolation method depends upon the number of expansion functions and the number of subdomain of the integration domain. For practical purposes, approximate results can be obtained by the singularity-isolation method, and then refined quantitatively by the regularization or projection method. Tables 3. References 8: 5 Russian, 3 Western.

[285-6900]

UDC 551.510.535

NONLINEAR PERTURBATION OF PHASE FRONT OF HIGH-POWER MICROWAVE BEAM IN  
IONOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 pp 665-670

BELOZEROVA, L.P., VASYUTKIN, A. M., YERYSHOV, N.M., and KRASOVSKIY, V. L.

[Abstract] This study investigates the perturbations of ionospheric plasma in the F-layer caused by powerful microwave radiation with parameters characteristic of solar space power plants. Distortion of the phase characteristics of the beam as a whole is investigated, disregarding the issue of small-scale delamination. The structure of the beam sent from the ground is investigated at sufficiently high altitudes, where even a relatively slight distortion of the wavefront caused by the ionosphere has a significant influence on the spatial distribution of the intensity, and can be recorded by satellite. The spatial behavior of the field intensity at long distances from the emitting aperture is found analytically. It is shown that the parameters of the ionospheric plasma are disturbed significantly as the beam propagates, and that the phase and amplitude characteristics of the beam are distorted due to nonlinear interaction. The additional phase change may be as great as  $2-30\pi$ . Anisotropy of the transmission coefficients in the geomagnetic field cause the cross-section of the beam to become deformed. These factors must be taken into account when designing experiments to model physical processes in the ionosphere. Figures 7. References 11: 6 Russian, 5 Western.

[285-6900]

UDC 621.372.826:621.315.61

ANOMALOUS MODE PROPERTIES OF DIELECTRIC COMB WAVEGUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 28 Feb 83) pp 812-814

LEVCHENKO, Ye. G. and MINOV, O.N.

[Abstract] An anomalous field distribution effect on different modes in the cross-section of a comb dielectric waveguide consisting of a dielectric plate holding a comb consisting of the same material is described. The relative distance at which the electrical field intensity drops off by a factor of  $e$  from the edge of the comb is plotted as a function of the generalized frequency in the waveguide for  $E_{11y}$  and  $E_{12y}$  waves. The regularities detected are found to hold for  $E_{mnx}$  and  $E_{mny}$  with  $n \neq m$ . The analytical figures are verified experimentally. Figures 2. References: 2 Western.

[285-6900]

UDC 517.958:535.4

SOLUTION OF BOUNDARY VALUE PROBLEM OF SCATTERING OF  $H_{p0}$  ELECTROMAGNETIC WAVES BY FERRITE-DIELECTRIC CYLINDRICAL INHOMOGENEITY IN RECTANGULAR WAVEGUIDE REGION

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-MATEMATYCHNYKH NAVUK in Russian No 2, Feb 85 (manuscript received 29 Jul 83) pp 9-16

MOSHINSKIY, A.V. and KLIMCHUK, S. F., Institute of Mathematics, Belorussian SSR Academy of Sciences, Minsk Radiotechnical Institute

[Abstract] The scattering of  $H_{p0}$  electromagnetic waves in a rectangular waveguide with a cylindrical composite ferrite-dielectric structure running parallel to the electrical field vector is modeled. The electrodynamic problem for a longitudinally magnetized ferrite consists of solving scalar Helmholtz equations for the corresponding regions. The solution of the boundary value problem is constructed on cylindrical wave functions corresponding to the geometry of the problem. It is found that if the frequency of the primary (instant) field is such that  $\pi/a < k_0 < 2\pi/a$ , the only wave propagating in the scattered field will be the  $h_{10}$  wave. In the multi-mode condition when, e.g.,  $k_0 > 2\pi/a$ , the inhomogeneity will excite a series of propagating  $h_{m0}$  waves in the  $D_3$  region. The problem of wave scattering on a plasma cylinder in a rectangular waveguide can be solved analogously.

References 11: 9 Russian, 2 Western. Figures 1.

[281-6900]

UDC 621.378.4

EFFECT OF DISPERSION ON FREQUENCY TRIPLING IN WAVEGUIDE CONDUCTING SYSTEMS WITH CUBICALLY NONLINEAR DIELECTRICS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 28, No 3, Mar 85 (manuscript received 5 July 84) pp 53-56

KONONOV, M.V., KOSHEVAYA, S.V. and OMELYANENKO, M. Yu.

[Abstract] Tripling of the frequency of electromagnetic waves in cubically nonlinear dielectrics introduced into a microwave waveguide system is considered. It is shown that with an optimum choice of the dispersion characteristics of the latter, a substantial increase (as compared with the case of an unlimited nonlinear medium) of the effectiveness of conversion is possible at the cost of compensation of nonlinear detuning brought about by the Kerr effect. This work is very heavily based on a 1980 paper ([1] in text), where an evaluation is made of the operation of solid-state frequency multipliers with a travelling wave, where an active media of ferroelectric crystals are used at a temperature  $T$  above the Curie temperature, the dielectric constant of which depends on the voltage of the electrical field

$\mathcal{E}(T, E) = \mathcal{E}_0(T, 0) -- d(T)E^2$  [1]. Losses in the centimeter and millimeter range were insignificant and dispersion negligibly small. It was shown in particular that in the absence of a constant electrical field in the idealized case of negligibly small losses in a transversely unrestricted nondispersing cubic nonlinear medium (see [1]), generation is possible of a 3rd harmonic of the pumping wave, with maximum effectiveness of the process of tripling significantly small units. Figures 3; references: 3 Russian.  
[267-6415]

UDC 533.9.029.6.01

## SELF-ACTION OF MICROWAVE FIELD PULSES DURING PASSAGE THROUGH WEAKLY IONIZED GASEOUS MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 7 Sep 83) pp 270-275

ROGASHKOVA, A.I., CHERNOV, Z.S. and SHATALOVA, T.I.

[Abstract] Passage of microwave pulse packets through a gaseous medium is analyzed from the standpoint of energy absorption and plasma formation dynamics. The corresponding system of partial differential equations of pulse propagation as a transient process is formulated and normalized, assuming a weakly ionized gas which becomes heated and additionally ionized in the process. This system of equations, with nonlinear coefficients, is applied to and solved for two successive pulses of duration  $\tau \ll 1/\omega$  ( $\omega$  - wave frequency) which remain far from the medium boundaries so that edge effects can be disregarded. The problem has been solved numerically on an M-4030 computer for an electric field with the longitudinal profile

$$-(\frac{z-z_1}{c\tau})^2 - (\frac{z-z_2}{c\tau})^2$$

$E(z) = A_1 e^{-\frac{(z-z_1)^2}{c\tau}} + A_2 e^{-\frac{(z-z_2)^2}{c\tau}}$  and three pressure ranges characterized by the magnitude of the ratio of collision frequency  $\nu$  to wave frequency  $\omega$ : 1) high pressure ( $\nu/\omega \sim 1$ ); 2) intermediate pressure ( $\nu/\omega \sim 0.1$ ); 3) low pressure ( $\nu/\omega \ll 0.1$ ). The results reveal that in all pressure ranges and in an electric field of intensity within the critical range the second pulse becomes appreciably distorted by discharge following the first pulse, if the time interval between pulses is shorter than the discharge time. The mechanism of energy absorption depends on the pressure, ionizational instability occurring at low pressure unless the initial amplitude of the second pulse is sufficiently small. Loss of energy during passage of pulses occurs not only as a result of energy absorption by the gas but also as a result of partial pulse entrapment by the plasma. Figures 4; references 2: 1 Russian, 1 Western (in Russian translation).

[220-2415]

DIAPHRAGMS AND DIELECTRIC WINDOWS IN RECTANGULAR MULTIMODE WAVEGUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 10 Jun 83) pp 230-238

LYAPIN, V.P., MANUILOV, M.B. and SINYAVSKIY, G.P.

[Abstract] The problem of diffraction by diaphragms in rectangular multimode waveguides is formulated as a problem of electrodynamics and solved by the method of partial regions, generally for a diaphragm of finite thickness as well as specifically for a dielectric window and a dielectric post diffracting  $H_{p0}$ -mode or  $H_{0p}$ -mode waves. The corresponding system of integral equations, assuming a lossless isotropic dielectric and ideally conducting waveguide walls, is solved by the Galerkin method. After the sought functions have been expressed as series of Gegenbauer polynomials, it is reduced to a system of linear algebraic equations for their coefficients. In the matrix of this system only the elements of the principal diagonal converge slowly, all other elements have an exponentially fast decreasing multiplier. Evaluation of all matrix elements and subsequent numerical solution of the problem have been programmed in ALGOL for a BESM-6 high-speed computer. Results of typical calculations, reflection and transmission coefficients for various dimensional waveguide and window or post proportions, agree with experimental data and reveal the essentially different behavior of the two inhomogeneities in the multimode range. An inductive diaphragm as part of a window excites higher-order modes, while the behavior of a post as capacitive diaphragm in the multimode range is almost the same as in the single-mode range. The results are applicable to the design of simple filters, tuners, and other waveguide components. Figures 5; tables 1; references 6: 5 Russian, 1 Western (in Russian translation).

[220-2415]

MILLIMETER RANGE ATTENUATOR BASED ON DIELECTRIC STRIP WAVEGUIDES

Moscow RADIOTEKHNIKA in Russian No 4, Apr 1984 (manuscript received 7 Aug 1984) pp 60-62

MURMUZHEV, B.A.

[Abstract] The paper is concerned with an investigation of the insertion loss, initial losses, and the standing wave ratio of an attenuator based on dielectric strip waveguides which are manufactured from polymere materials in the frequency range of 100  $\div$  200 GHz. In comparison with better foreign attenuators of a similar type, based on single-mode metal waveguides, an attenuator based on dielectric strip waveguides, adaptable to streamlined production methods, has a smaller input standing wave ratio and losses at the junction elements, and at the same time a greater accuracy of reading

insertion losses. The author thanks V.V. Meriakei for helpful discussion of the work. Figures 3; references 6: 5 Russian, 1 Western.  
[257:6415]

UDC 535.8:535.214.4

MULTICHANNEL RADIOMETER OF 5-MILLIMETER BAND FOR DISTANT THERMAL SOUNDING OF ATMOSPHERE

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 2 July 1984) pp 62-64

RASSADOVSKIY, V.A., TROITSKIY, A.V., VOLOKHOV, S.A., and SINENKO, A.S.

[Abstract] The paper describes in detail the basic parameters and structural features of a 4-channel semiconductor radiometer (band = 53.5 - 55 GHz) developed and produced at the Institute of Scientific-Research Radiophysics at Gorkiy State University im. N.I. Lobachevskiy. The radiometer is intended for distant investigation of the atmosphere with the object of determining its high-level profile. Figures 1; references: 2 Russian.  
[257:6415]

UDC 621.316.729

SYNCHRONIZER OF FREQUENCY OF CENTIMETER, MILLIMETER, AND SUBMILLIMETER RANGE

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 23 June 1984) pp 58-60

AGANBEKYAN, K.A., PLOKHOTNYUK, Ye.F., and STROGANOV, L.I.

[Abstract] The paper describes in detail a method of constructing systems of frequency stabilization of superhigh frequency generators, with the use of phase locking and the Ch5-13 frequency converter. The method makes it possible to expand the frequency range from 16 to 460 GHz. Figures 2; references: 8 Russian.  
[257:6415]

COMMUNICATIONS

UDC 621.372.011.71:018.78

QUICK COMPUTATION OF DISCRETE FRESNEL TRANSFORM

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 17 Sep 84 after revision) pp 92-94

VLAZENKO, V.A. and KATUSH, A. KH. M.

[Abstract] The Fresnel transform  $a(t)$  of a digital input signal is defined as the convolution of the real signal  $S(t)$  and the analytical signal  $\Lambda(t)$  obtained by Hilbert transformation of  $a(t)$ . Formulas are derived for calculating the discrete Fresnel transform, and three algorithms implementing the transform are examined and compared. The algorithm based on computing the convolution of the Fresnel transform in the spectral domain is found to be best in terms of the number of multiplications required. Tables 1.

References: 6 Russian.

[287-6900]

UDC 621.391.268

NOISE TOLERANCE OF ADAPTOR DETECTOR FOR WIDEBAND NOISE SIGNAL USING LEARNING WITH TEACHER

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 9 Jul 84) pp 28-31

PESHKOV, V.P. and SENKO, A. Ye.

[Abstract] General analytical expressions are derived for the parameters of the Gaussian approximation of the distribution of the output statistic of an adaptive detector, which are used to analyze noise tolerance in the case of weak signals using "learning with a teacher", i.e., with the estimates of the unknown parameters formed on the basis of classified learning realization of the interference and the signal-interference mixture, after which the working realization within which the signal is to be detected is input to the detector. The asymptotic properties of the detector are investigated, and the noise tolerance losses are calculated for different ratios of the lengths

of the learning and working realizations. The analysis makes it possible to make a substantiated choice of learning time and detection time as a function of the requirements for the noise tolerance of the noise signal detector when the signal and interference spectra are indeterminate a priori. Figures 1. References: 6 Russian.

[287-6900]

UDC 621.391.8

INVESTIGATION OF POSSIBILITIES OF DETERMINING PARAMETERS OF GENERALIZED AMPLITUDE (POWER) PROBABILITY DISTRIBUTION OF GAUSSIAN RADIO SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODEKTRONIKA in Russian Vol 28, No 4, Apr 85 (manuscript received 10 Jul 84) pp 42-47

GORKIN, Yu. S. and RADZYEVSKIY, V.G.

[Abstract] A method and algorithm are described for determining the parameters of the form of the generalized amplitude (power) probability distribution of Gaussian radio signals from the measured values of the coefficients of variation, asymmetry and excess of the power of random signals. The method makes it possible to describe various random processes analytically and to integrate them from unified viewpoints. The proposed algorithm can be implemented on contemporary computers, and make it possible to automate the investigation of the fine statistical structure of fluctuations of Gaussian radio signals by exploiting the information they contain more fully.

References: 7 Russian.

[287-6900]

UDC 621.396.67

ERROR OF MICROPROCESSOR IMPLEMENTATION OF ALGORITHMS FOR SPACE-TIME RADIO SIGNAL PROCESSING

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODEKTRONIKA in Russian Vol 28, No 4, Apr 85 (manuscript received 16 May 84 after revision) pp 60-62

GLUSHANKOV, Ye.I. and KOBIN, S. V.

[Abstract] Specific errors related to microprocessor implementation that can cause loss of stability and divergence of space-time processing algorithms are analyzed for the Widrow-Hoff algorithm and the discrete Kalman filtering algorithm. Versions of these algorithms, modified for microprocessor implementation, are presented. Quantization errors, machine errors, round-off and truncation errors, and parametric errors are analyzed. It is found that these errors can be significant, which is equivalent to increased amounts of concentrated interference, or reduced numbers of elements

in the adaptive antenna array. The relationships derived can be used in selecting the word length of the analog-digital converters and microprocessors employed, which reduces error significantly. Figures 1. References 11: 9 Russian, 2 Western.

[287-6900]

UDC 621.391.26

#### USE OF ECHO PROCESSOR IN MATCHED FILTER MODE FOR RADIO PULSE BURST

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODEKTRONIKA in Russian  
Vol 28, No 4 (manuscript received 24 Sep 84) pp 63-66

BARUZZIN, S. A., SKOBLIKOV, S.N. and USTINOV, V. B.

[Abstract] The noise tolerance degradation of an echo-processor based radio frequency pulse burst detector is analyzed in comparison with an optimal receiver. Formulas are derived that make it possible to select the optimum relationships between the number of pulses accumulated, their repetition period, and the longitudinal (spin-lattice) relaxation time of the working substance of the echo processor with allowance for acceptable noise tolerance degradation, as well as to assess the effectiveness of accumulation as compared with detection without accumulation, and with optimum noncoherent accumulation. The echo-processor based detector is invariant to the structure of the signals processed, as well as their repetition period. Figures 2. References 5: 4 Russian, 1 Western.

[287-6900]

UDC 621.391.23.019.4

#### NOISE TOLERANCE OF QUASI-COHERENT DIVERSITY RECEPTION OF MARKOV SIGNALS IN DIGITAL COMMUNICATIONS LINES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 2 Oct 84 after revision) pp 72-74

BORTNIKOV, V.V.

[Abstract] Analytical expressions are derived for the noise tolerance of quasi-coherent reception of discrete messages in a Markov statistically inhomogeneous channel with different types of diversity and independent slow Rayleigh fading. The error probabilities are calculated for the example of synthesized quasi-coherent reception algorithms for phase-shift keyed signals. The structural diagram of a quasi-coherent diversity receiver for frequency shift keyed signals is presented. Although the synthesized algorithms employ effective measures to reduce losses in the coherence of the weighted addition of the circles in the diversity reception branches, the algorithms are more suitable for more than one diversity reception branch

and relative rates of change of the continuous Markov processes of less than  $10^{-4}$ . Figures 2. References: 6 Russian.  
[287-6900]

UDC 621.391.26

#### SELECTION OF WEIGHTS IN GRADIENT TUNING ALGORITHM FOR LATTICE FILTERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 16 Apr 84) pp 91-92

LAVRENYUK, V.N.

[Abstract] The selection of weights for the gradient tuning algorithm employed by lattice filters for signal processing is analyzed. It is shown that this selection is optimal in the sense of the minimum standard error in the steady-state condition when the gradient algorithm is used. The practically attainable gain in standard error is compared with an algorithm not using weighting which is simpler to implement. Computer simulation of a first-order input Markov process indicates that equal weights should be used. Figures 1. Reference 4: 1 Russian, 3 Western.  
[287-6900]

UDC 621.391.278

#### MAXIMUM EFFECTIVENESS OF FREQUENCY-TIME SIGNAL DUPLICATION IN ADAPTIVE COMMUNICATIONS LINKS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 25 Oct 84 after revision) pp 8-13

MARINICHEV, Ye. G. and SIKAREV, A.A.

[Abstract] The use of frequency and time duplication of signals to neutralize the energy loss caused by inertia of devices used to track the best frequency for communications is analyzed. The maximum efficiency of digital message transmission using the best frequency-time positions is estimated statistically for given noise level distributions in adaptive and non-adaptive radio links. The interference distributions at the output of the frequency-time signal selection device in the receiver are analyzed by computer for Rayleigh and log-normal initial distributions. The effectiveness of autoselection is found to increase as the variance of the interference distribution, and is highest for the log-normal case. Stochastic adaptation methods (in accordance with the results of load analysis) for the structure of complex received signals are found to be most effective. Figures 6, References: 4 Russian.  
[287-6900]

UDC 621.391.2

SEQUENTIAL RANKING RULE FOR SIGNAL DETECTION AGAINST BACKGROUND OF MARKOV INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 4, Apr 85 (manuscript received 17 May 84) pp 20-24

AKIMOV, P. S. and NEDOLUZHKO, V.I.

[Abstract] A sequential truncated detector is investigated which is a modification of the binary Neumann-Pearson rank detector that is capable of operating in Markov interference. The procedure is based on placing upper- and lower-bound constraints on the decision statistic. A method is presented for calculating the distribution of the number of observations for single- and multi-channel detectors operating in Markov interference. The gain of the sequential truncated multichannel ranking section procedure is estimated for different numbers of channels and interference correlation coefficients in comparison with a single-threshold Neumann-Pearson procedure providing the same performance in terms of false-alarm and correct detection probabilities. The sequential truncated rule can be used for sign detection, as well as detection based on binary quantization of signals. Figures 2. References: 3 Russian.

[287-6900]

UDC 621.396.43

KURS-8-02 ANALOG-DIGITAL RADIO RELAY TRANSMISSION SYSTEM

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 19 Oct 84) pp 3-7

POBORCHIY, Ye. D.

[Abstract] The KURS-8-02 (Oblast-2) analog-digital radio relay transmission system is described. This system is designed to provide internal oblast long distance telephone lines up to 150-200 km long, and to support municipal and certain rural interoffice trunks between central, node, and terminal automatic telephone exchanges. The KURS-8-02 is available in two versions: one in which a 300-channel FDM analog line circuit is provided, and one in which a TDM/PCM digital line circuit with a capacity of 120 voice grade channels is provided. The KURS-8-02 consumes one-third of the power of the existing KURS-8-0. The layout and design features of the equipment are described. The KURS-8-02 equipment has been tested experimentally in analog and digital transmission systems. The digital version, which improves the performance of communications channels significantly, is especially promising. Figures 6. References: 5 Russian.

[286-6900]

UDOP-17 DEVICE FOR REMOTE IDENTIFICATION OF AN UNATTENDED REPEATER WITH DEGRADED CROSSTALK ATTENUATION

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 (manuscript received 3 Apr 84)  
pp 7-11

BREYMAN, Ye. I., GURIN, O.I., ZAYTSEVA, L. A., KLAUZ, G. A. and SHASHLOV, S.P.

[Abstract] A device is described that makes it possible to identify remotely (from an attended repeater when the system is being brought on line) unattended repeaters at which the protection against near-end audible crosstalk is degraded. The UDOP-17 device can be employed in all existing coaxial cable transmission systems. The device operates by sending a special test signal over the influencing line and extracting the crosstalk signal occurring at the tested unattended repeater by correlation processing of the received signal. The test signal is a harmonic signal that is phase-shift keyed by a quasi-random sequence of maximum-length pulses. The operation of the device is described in detail. The effectiveness of the UDOP-17 has been demonstrated on mainlines multiplexed with K-3600, K-1920U, K-1920P, K-1020, and K-300 transmission systems. Malfunctioning unattended repeaters can be found 10 times more rapidly than with the old method. It is possible to operate the device without shutting down the transmission system completely by connecting it to an available supergroup or mastergroup circuit. The UDOP-17 can also be used to solve the problem of far-end crosstalk. Figures 4. References: 4 Russian.

[286-6900]

APPLICATION OF ELECTRONIC CONTROL MACHINES IN SWITCHING EQUIPMENT

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 pp 24-27

MONINA, G.

[Abstract] This article reviews some of the papers presented at the All-Union Scientific-Technical Conference entitled "Application of Electronic Control Machines in Switching Equipment", which was held in Minsk in November 1984. The main emphasis at the conference was on the operation of switching systems employing stored-program control. The operating characteristics of the Kvarts stored-program long-distance quasielectronic telephone exchange are discussed. Experimental operation of the first experimental Istok systems are described. A report on microprocessors and their use in switching center control devices is summarized. A study on the relationship between the number of repeated call attempts and the exchange throughput capacity is cited. A report on the diagnosis of the Kvarts exchange control equipment demonstrates effective diagnostics based on a malfunction dictionary compiled from the results of physical modelling of malfunctions. Reports on connections between exchanges, the architecture of peripheral common channel

signalling programs, and the information exchange protocol between electronic control machines, are discussed. Reports on technical operating methods and ways of ensuring the reliability of electronic control devices are described. The creation of regional technical maintenance centers and a programming center for training qualified personnel to operate stored-program exchanges is recommended. A conference on experience gained in implementing stored-program switching facilities is planned for 1986.

[286-6900]

#### THE INTERNATIONAL TELECOMMUNICATIONS UNION -- PROGRESS IN INFORMATION TRANSMISSION FACILITIES

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 pp 51-55

KORBUT, N. Ye.

[Abstract] The history of the International Telecommunications Union (ITU), and of Russian/Soviet participation, is traced from the invention of the electrical telegraph by the Russian scientist P. L. Shilling to the present. The administrative structure of the current organization is explained. The functions of the CCIR and CCITT are explained. The history of the ITU reflects the development of telecommunications throughout the world, as well as the overall social transformation resulting from the invention and widespread use of the telegraph, telephone, radio, and television.

[286-6900]

#### EIGHTH CCITT PLENARY ASSEMBLY

Moscow ELEKTROSVYAZ in Russian No 4, Apr 85 pp 55-58

GLINKA, V. I., VORONIN, P. N. and NIKOLSKIY, K. K.

[Abstract] The results of the activity of each CCITT research committee during the 1980-1984 reporting period, as presented at the Eighth Plenary Assembly of the CCITT during 8-19 October 1984, are outlined. Fifteen research committees, working on subjects ranging from "definition and problems of telegraph and telematic operation (facsimile, teletex, videotex, etc.)" to "digital networks" revised existing recommendations and formulated new ones. The Plenary Assembly also adopted resolutions to create a special committee to prepare for a 1988 International Administrative Conference on Telephony and Telegraphy, to issue a new CCITT Red Book, to authorize the program of work of the research committees for the 1985-1988 research period, and to implement some structural changes, *inter alia*. The work of the Eighth CCITT Plenary Assembly has promoted the development and consolidation of international scientific and technical cooperation in telecommunications worldwide.

[286-6900]

## CONSULTATION FOR LINE-CABLE SERVICE WORKERS

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 44-45

PROMYSLOV, A. S. and KUZ'MIN, A. N., chief engineers, Central Scientific Research Institute for Communications

[Abstract] This article provides answers to a number of readers questions: how to install the connector on type MKSA cable by the hot method without damaging the styroflex insulation; how to install the improved type KCS cable connectors; how to prevent the center conductor from shifting or slipping out of the proper sleeve when insulating the coaxial pair of type VKPA cable with hot polyethylene, and whether insulating conductor washers can be used in installing connectors on VKPA 2.1/9.7 cable, and the type of insulating sleeves to be used to insulate the conductor connections for a branched quad in a K-1020 transmission system employing MKSA-4X4X1.2 cable. Figures 3.

[288-6900]

## SPACE COMMUNICATIONS IN THE SERVICE OF MAN

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 3-5

GAFUROV, A. G., head of Union Radio Broadcasting and Radio Communications Center No. 9

[Abstract] The role of satellites in supporting a wide range of types of communications is described. The Ekran and Moskva television broadcasting systems are described. The use of TDMA and FDMA equipment at Orbita-2 stations to support telephone and telegraph communications is described. The multi-program Orbita-RV radio broadcast system is explained. International cooperation in the development of satellite communications systems, including Intersputnik, is discussed. The functions of Union Radio Broadcasting and Radio Communications Node No. 9, which is subordinate to the USSR Ministry of Communications, as a space communications center and a supervisory point for the construction, operation, control, and testing of all satellite communications systems is described. Research being performed at Dubna on space communications is mentioned. Figures 3.

[288-6900]

## INTRODUCTION OF IKM-120 TRANSMISSION SYSTEMS IN MUNICIPAL TELEPHONE NETWORKS

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 32-33

BERLIN, B. Z., deputy chief engineer, Leningrad Municipal Telephone System, and DRANITSYN, A. F., senior engineer, Production Laboratory

[Abstract] The operation of an experimental IKM-120 digital transmission system on a line between an automatic exchange in Leningrad and a suburban regional exchange served by a two-cable system is described. The IKM-120 system supports up to 120 voice grade channels per line circuit by combining four 2048 kbps digital streams into a single 8448 kbps stream. The equipment is designed for use on internal zone and municipal telephone networks employing ZK and MK balanced cables; IKM-30 multiplexing equipment is employed. The configuration of the equipment at both of the terminal exchanges, which are 43.8 km apart, is described. It is found that the IKM-120 can be used in municipal systems to set up large groups of trucks within cities, as well as to provide communications with suburban exchanges. The results of an analysis of failures observed in various components in 18 months of operation are tabulated.

[288-6900]

## DETERMINATION OF DISTANCE TO LOCATION OF REDUCED RESISTANCE OF INSULATION BY ZERO POTENTIAL METHOD

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 34-35

ARKHANGELSKIY, G. A., candidate of engineering sciences

[Abstract] A method is described for determining the distance to a damaged area of insulation in underwater cables. When voltages with different polarity with respect to the seawater are applied at both ends of the section, a zero-potential point is formed in the cable. By changing the value of these voltages while holding their sum constant, the zero-potential point can be shifted along the entire cable: when this point reaches the location of damaged insulation, the noise in the channel is smallest. Formulas are presented for determining the distance to the zero potential point. The error of the method is greatest if the damage is close to an amplifier (or in the amplifier itself), and was found to be as much as 13.7 km for an actual line with dc resistance of the amplifier remote power supply circuit of 290 ohms and dc resistance of the cable circuit in the repeater section of 56.7 ohms. The error depends upon the errors of the instruments employed, the temperature gradients along the cable, the length measurement errors, and the dispersion of the dc resistances of the amplifier remote power circuits.

Figures 2.

[288-6900]

## ECONOMIC EXPERIMENT TO IMPROVE MANAGEMENT OF MINSK MUNICIPAL TELEPHONE NETWORK

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 pp 35-37

VERZHBITSKAYA, Z. A., head of planning department, Minsk Municipal Telephone Network

[Abstract] An economic experiment to improve management in the Minsk Municipal Telephone Network since the fourth quarter of 1983 is described. The objective of the experiment was to improve productivity, to reduce labor and material costs, and to improve performance indicators. Experimental mixed teams consisting of engineering and technical workers and laborers were formed, making it possible to increase labor productivity by 6.7% and to eliminate 9 positions. The number of individuals performing more than one duty was increased from 170 to 215, making it possible to eliminate 52 positions. The use of economic incentives for workers is described. The basic operating indicators of the Minsk municipal telephone network improved significantly during the experiment: the prime cost per 100 rubles of production was reduced by 3.1%; the projected tariff income was exceeded by 0.7%, and the projected profit by 2.9%; labor productivity was increased by 7.9%; and the annual plan for labor productivity was overfulfilled by 4.7%, with a 100% growth in production volume. New obligations for 1985 are described.

[288-6900]

## IMPROVING MAINTENANCE OF RURAL TELECOMMUNICATIONS FACILITIES

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 22-24

SAVCHENKO, K. I., head of Orshanskiy Technical Communications Center, Vitebsk Oblast

[Abstract] The operation of the Orshanskiy Technical Communications Center, which maintains telecommunications facilities serving four rayons in Vitebskaya oblast, is described. While there has been a 2.5-fold increase in the number of rural automatic telephone exchanges, and a 3.4-fold increase in their capacity, over the past 10 years, the staff of the Orshanskiy Center has remained unchanged, at approximately 70% below full strength. An experimental approach to facilities maintenance is described in which pre-arranged routes are traveled by maintenance personnel on a scheduled basis, with all facilities along the route checked each time. Statistical testing of type ATSK-100/2000 exchanges is described. The organization of the dispatcher services in the four shops serving the Orshanskiy Center is described. A special dispatcher console developed on the basis of an MKS-20X10X6 multiple crossbar connector is described that is used by the dispatchers for trunk testing. Although labor productivity has improved, productivity quotas have been overfilled, and the prime cost of production has been reduced. Unresolved problems remain: a consolidated centralized system for monitoring and testing all telecommunications facilities in a region is being developed to allow centralized control from the console serving the duty electrician in the line equipment room. Figures 3.

[283-6900]

## EXPANSION OF TELEPHONE SERVICE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 24-25

BILDYUKEVICH, Yu. A., head of Sevastopol Municipal Telephone Network, candidate of atomic sciences

[Abstract] A special form of billed telephone service is described in which customers can place calls from special pay telephones or home telephones to a central facility that provides a range of services for subscribers including ordering of prescriptions, ordering and home delivery of foodstuffs, providing childrens' stories, sports scores, dial-a-joke, current weather, and traffic conditions, inter alia. The performance of the service and the peak load distribution as compared with telephone exchange load distribution are analyzed. The development of a consolidated facility to support this service is discussed. Figures 4.

[283-6900]

## RECOMMENDATIONS FOR CONNECTION OF TYPE AVTS EQUIPMENT TO ATSK-100/2000 EXCHANGE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 29-30

YELEKOYEVA, E.K., chief engineer, and MELAMUD, E. A., candidate of engineering sciences, LONIIS Laboratory Chief

[Abstract] This study describes the connection of automatic internal oblast telephone communications (AVTS) equipment to type ATSK-100/2000 automatic telephone exchanges. AVTS equipment employs carrier channels, and carries out call accounting with the help of electromechanical meters. The procedure for preventing subscribers not having meters from accessing the oblast center are described. A method for connecting meters is shown that makes it possible to set up four-wire tandem connections of carrier channels for internal rayon and incoming long distance calls. The connection of the jumpers to the e lead in the subscriber loop interfaces serving subscriber loops not equipped with meters to prevent the application of negative battery is described. Figures 2.

[283-6900]

## AUTOMATIC SWITCHING DEVICE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 32-33

KOZINA, G. A., innovation engineer, Production-Technical Communications Administration, Primorskiy Kray

[Abstract] An automatic device is described for switching to the spare radio relay channel in the SRP-11 receiving equipment room when the main signal from the Orbita station is lost. The device eliminates the long time delay required for manual switchover, and permits instantaneous switching from one program source to another without human intervention. The circuit diagram of the automatic switching device is presented and traced. The circuit, which incorporates a visual display, has been tested repeatedly, and shown to perform well. Figures 3.

[283-6900]

## IMPROVEMENT OF QUALITY OF DEVELOPMENT AND FABRICATION OF ARTICLES

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 42-43

SHPIRT, G. B., head of experimental department, Odessa Branch, Central Design Bureau

[Abstract] The author describes integrated quality control systems employed in the manufacture of electronic and other telegraph equipment. The history of the system employed at the Odessa Branch of the Central Design Bureau is traced from its initial registration with Gosstandart in 1981. The use of integrated quality control systems in the design and manufacturing phases has improved product reliability and quality, and has increased the savings achieved by introducing new telegraph equipment. The quality control systems in place at operating communications enterprises have not yet been tied in with the quality control system employed at GUPP (Main Administration of Industrial Enterprises). When this is accomplished, an additional means will be available for improving the quality and reliability of articles delivered for use in the telegraph network, as well as the entire communications branch. Figures 2.

[283-6900]

## CONSULTATION ON ORGANIZATION OF K-60P CARRIER CIRCUITS IN SINGLE-CABLE MODE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 85 pp 47-48

VERNIK, S.M., Doctor of Engineering Sciences, head of department of communications links, Leningrad Electrotechnical Communications Institute imeni Professor Bonch-Bruyevich, and NIKITIN, B. K., candidate of engineering sciences, docent

[Abstract] The authors describe the use of one of the cables on a repeater section of a two-cable balanced mainline to carry traffic in both directions when the other cable is out of service for repair, preventive maintenance, or adjustment. Special single-cable devices are described that make it possible to maintain good transmission quality on the single substitute cable. The single-cable devices consist of a transmitting part that translates the K-60P spectrum to 303-543 kHz, and a receiving part that converts the spectrum down again. The transmitter and receiver are placed at the appropriate unattended repeater on the repeater section. The use of a linear power amplifier maintains the calculated signal level in the 303-543 kHz spectrum with the required slope of the amplitude-frequency characteristic of the transmitter, providing partial compensation for the attenuation of the cable circuits in that band. The operation of the linear power amplifier in conjunction with a low-noise amplifier keeps the parameters of the line spectrum at the output of the receiving section in almost complete accord with the parameters of the K-60 line spectrum on the repeater section in question. The single-cable device can be used on physical circuits carried by balanced type MKS cables with repeater section lengths of 12-21 km. Procedures for operating the devices are described. Figures 1.

[283-6900]

UDC 621.317.7:621.396.61

## EQUIPMENT FOR MEASURING PERFORMANCE INDICATORS OF TRANSMITTERS IN NATIONWIDE RADIO COMMUNICATION SYSTEM

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 6 Jul 84) pp 1-5

POLYAKOV, L.A., GALKIN, N.P., ALEKSEYEV, V.M. and VYUSHKOV, A.F.

[Abstract] A new special-purpose equipment for measuring the basic performance parameters of transmitters in the nationwide radio communication system has been developed, to replace scarce and obsolescent SK5-1 and SK3-25 measuring instruments as well as "Purga" monitoring devices. It includes a restorer with frequency synthesizer for converting the high-frequency signal, filters for separating the test signal from the reference signal, a linear average-value detector and a square-law effective-value detector for both signals, with computation of the logarithm of their ratio, a controllable scale amplifier, a detector of frequency-keyed signals in

F1 or F6 mode of operation, a meter of telegraph signals dominance and peak distortion level, a commutator for switching from measurement of one parameter to another, and a power supply stabilized for 198-242 V and 47.5-51.5 Hz fluctuations of the power line. The entire instrument bay draws a power of not more than 200 VA. Its error does not exceed 2 dB, is in most cases within 1 dB, in measuring harmonic or combination third and fifth orders nonlinear distortion not exceeding -50 dB, in measuring rms noise levels not exceeding -55 dB within the 300-3400 Hz frequency range of lower or higher sideband, in measuring rms parasitic amplitude modulation of the carrier not exceeding -55 dB, in measuring rms background signals within the 30-200 Hz frequency range not exceeding -50 dB, and in measuring linear cross-talk distortions not exceeding -60 dB. The equipment was checked out on SUR-1 and SUR-3 radio centers. Figures 3; references: 8 Russian. [262-2415]

#### MEASURING POWER OF SPURIOUS RADIATION IN RADIO TRANSMITTERS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 15 May 84)  
pp 6-7

LANDSMAN, M.S.

[Abstract] A method of measuring the power of spurious radiation in feeder lines of long-wave, medium-wave, short-wave radio transmitters principally but also in other transmitters is proposed. It is free of the difficulties with connection and alignment of directional couplers used in conventional methods. Its gist is using a high-frequency impedance bridge or similar device tuned to the frequency of spurious radiation and measuring the feeder input admittance, with the feeder line disconnected from the transmitter and connected to the loading antenna. The validity of this method derives from the circuit relations, demonstrated here on a symmetric feeder line with two busbars of opposite polarities on both sides of the grounding wire. Calculation of the admittance as well as of its first and second derivatives with respect to the longitudinal space coordinate from the applicable voltage and current equations, assuming a distributed conductance, reveals its minima and thus the corresponding voltage crests along a feeder line. After subsequent calculation of both incident and reflected power on this basis, the difference of both represents the net power of spurious radiation. Numerical data are given pertaining to power at two harmonics (second and third) in a "Tesla SRV-7" transmitter operating at 549 kHz, this spurious power having been also measured with M2-22/23 instruments using filter-wire shields for overload protection and a selective voltmeter through a capacitive frequency-independent fixed-ratio voltage divider. Figures 1; tables 1; references: 3 Russian. [262-2415]

DIAGNOSIS OF FAULTS IN MODULES OF LOW-SPEED CHANNEL FORMING SYSTEMS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 16 Jun 83)  
pp 21-23

FINKEL, Ye.V.

[Abstract] The mean time of restoring a faulty device to service consists of the mean time of preparing for diagnostic inspection, the mean time of diagnostic testing, the mean time of fault clearing, and the mean time of post-repair checking. The mean time of preparing for diagnostic inspection depends on the number of parameters to be measured and on the number of points at which measurements must be made, it is the sum of instrument setting time and access securing time. The other components of restoration time, except fault clearing time, depend on these factors accordingly. Acceleration of the diagnostic process along with post-repair checking is possible with proper layout of operations and availability of equipment. Computer-aided testing and checking is most expedient, inasmuch as it minimizes the cost of special-purpose hardware. The first step is fault localization, which requires a strategy or test sequence appropriate for any given type of channel. The state index of an inspection object, defined as the ratio of two a posteriori probabilities  $p_s(t)/p_f(t)$  ( $p_s$  - probability of sound condition,  $p_f$  - probability of faulty condition) as functions of time, is proposed as criterion for devising the appropriate fault search strategy. The procedure is demonstrated on a TT-48 low-speed telegraphic channel consisting of fixed and variable resistors, electrolytic and other capacitors, inductance coils, transformers, transistors, diodes, toggle switches, plug and socket connectors, and soldered joints with known fault rate statistics. Figures 2; tables 2; references: 10 Russian.

[262-2415]

DETERMINATION OF NUMBER OF CHANNELS FOR INTERURBAN TELEPHONE NETWORK WITH ALTERNATE ROUTING AND MODULAR TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 30 May 84)  
pp 24-29

DEDOBORSHCH, V.G., ILINA, L.D. and LEVINA, G.B.

[Abstract] A major problem in planning and design of a territorial inter-urban telephone network, namely determining the number of channels, is solved for networks with 2-level hierarchy: AMTS automatic exchanges at the first level and UAK-1 (class 1) automatic switching at the second level. Into account is taken modularity of the transmission system, a module forming a 12-channel group in an analog system. The necessary relations are derived

for calculating not only the number of direct-route channels but also the number of alternate indirect-route channels in a heavy-traffic network and the number of last-choice-route channels, on the basis of graphical layout and given load characteristics. They are shown for the simplest schemes with one alternate route and with two alternate routes respectively. An optimization process has been devised on the basis of these relations and their analysis, already programmed in FORTRAN for a YeS-1030 computers and applicable to networks which cover territories with up to 900 exchanges including one or several in the larger cities. Figures 5; references 5: 3 Russian, 2 Western.

[262-2415]

UDC 621.395.44

#### HYBRID LINE CHANNEL FOR DIGITAL RURAL TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 1 Mar 84)  
pp 35-37

KIKVADZE, L.V.

[Abstract] Development of an analog-digital line channel is proposed for standardization of line equipment in digital rural transmission systems operating at various speeds, 1024 or 2048 kbit/s, as a more reliable and less costly alternative to adjustable regenerators. The design of such a hybrid channel, including distortion correctors at intermediate and terminal points as well as a special one in the terminal exchange, is based on analysis and evaluation of the transfer function which characterizes each point and the corresponding repeater section. Calculations have revealed that the nearly linear phase coefficient of KSPP symmetric cables used in these lines allows correction of the amplitude distortions only, with the accumulated phase distortion corrected in the terminal exchange equipment only. The correctors must have a variable sloping amplitude characteristic, for satisfactory performance under up to  $-40$ - $(+40)$ °C wide temperature changes and with a wide range of repeater section lengths. They can be regulated on the basis of current rather than voltage in a system with remote power supply and long feeders, which will simplify the hardware and improve the dynamics. The corrector in the terminal exchange can include both a fixed signal correcting circuit and an adaptive one, which will maximize the reception fidelity on the basis of average trunk characteristics and instantaneous trunk characteristics respectively. The channel will also include a crosstalk interference compensator, needed in the terminal exchange only, consisting of a tunable discrete transversal filter with tapped delay line. The final design step is determining the maximum permissible length of repeater sections based on the criterion of immunity to crosstalk interference. Figures 3; tables 1; references 9: 4 Russian, 5 Western (3 in Russian translation). [262-2415]

ADAPTIVE CORRECTOR FOR SINGLE-CONDUCTOR COMMUNICATION LINE

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 11 Jan 83)  
pp 41-43

MINCHENKO, I.S., MITROFANOV, A.V. and SHILOV, Yu.M.

[Abstract] An adaptive corrector is designed for wire communication lines, specifically single-conductor ones, with fluctuating amplitude-frequency and phase-frequency characteristics. In an electrically long line the attenuation coefficient is usually a monotonically increasing function of frequency with a wide spread over the operating frequency range. In this case the amplitude-frequency characteristic can be described approximately as the sum of two slowly varying functions of time which are also functions of frequency, a monotonic one and a random one respectively. The synthesizer of frequency characteristics, the principal component of this corrector, operates on the basis of the Butterworth polynomial approximation. An amplifier with inductive automatic gain control at the synthesizer output sends a signal of constant amplitude to an analyzer. Here distortions of the envelope of the spectral density characterizing the signal are estimated and an appropriate error signal is generated. This signal is sent to a control device which generates the appropriate control voltage for the synthesizer. The polynomial synthesizer consists of five constant-gain decoupling amplifiers on 140UD1B microcircuit chips, two summing operational amplifiers with inverting connection on 140UD8 microcircuit chips, and attenuator pairs built on KR504NT4A field-effect transistors with impedance regulation to ensure identical attenuation coefficients in a pair. The analyzer consists of a 2-stage discriminator with narrow-band filters, the control device is an array of differential amplifiers with two inputs, one for the error signal and one for the reference signal. The voltage at the analyzer output can be varied over a 7.5 V range, with 1.5 V discrete steps of the reference voltage. Gain control of the amplifier at the synthesizer output ensures an 80 dB dynamic range of signal reception. Figures 3; references: 4 Russian.

[262-2415]

EFFECTIVENESS OF ONE METHOD OF SUPPRESSING PULSE INTERFERENCE

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 17 Jun 83)  
pp 44-47

BYKHOVSKIY, M.A.

[Abstract] Suppression of pulse interference in radio relay systems and in wire communication as well as in satellite communication systems by spectrum

transformation and signal limiting is evaluated, considering that blanking of the group channel is not a very effective method. The principle of a suppressor now proposed, consisting of a delay line (time delay equal to interference pulse duration) with a positive feedback loop around it and a voltage limiter with a negative feedback loop around it, is analogous to that of a much older device (D.V. Ageyev, 1947) consisting of a differentiating circuit followed by a voltage limiter and then an integrating circuit. The performance of the new suppressor is described by the equation  $f(v + \Delta\alpha - \varepsilon) + \varepsilon_\tau = \Delta\alpha + \varepsilon$  for a suppressor input signal  $w(t)$  and output signal  $\alpha^*(t)$ , with  $v(t) = w(t) - \alpha(t)$  denoting the signal distortion at the suppressor input and  $\varepsilon(t) = \alpha^*(t) - \alpha(t)$  denoting the signal distortion at the suppressor output. This equation with  $\Delta\alpha = \alpha(t) - \alpha(t - \tau)$  is solved, assuming that  $\Delta\alpha$  does not exceed the limiter threshold  $u_0$ , by replacing the difference equation with a differential one. Small distortion caused by this change is further reduced by raising the threshold voltage  $u_0$ , which will lower the frequency and shorten the duration of distorting pulses caused by overloading. An analysis of the solution, with interference absent and with interference present, indicates that this method is indeed more effective than blanking. It is less effective, however, than suppression by detection of interference and simultaneous signal restoration through extrapolation of the signal received prior to incidence of an interference pulse. Figures 4; references 10: 9 Russian, 1 Western.

[262-2415]

UDC 621.315.61

#### EFFECT OF TWIST ON MECHANICAL STRESSES IN FIBERS AND ON ADDITIONAL POWER LOSSES IN OPTICAL CABLES

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 13 May 83)  
pp 52-54

GOZMAN, N.Ya., LISITSYN, S.B., SEMENOV, N.A. and SHITOV, V.V.

[Abstract] The effect of twisting the damper-filler in optical fiber cables on the mechanical stresses and the power losses is evaluated, by calculating both the maximum tensile-compressive stress pair and the increment of the attenuation coefficient as functions of the two twist parameters: radius and pitch. The analysis is based on a straight cable with consideration of flexure. The general analytical relations are applied to a fiber-optic cable consisting of a solid cylindrical center core wrapped with a helical damper-filler inside an outer cylindrical polymer shell. The attenuation coefficient is found to increase as the twist pitch decreases and as the twist radius increases, inasmuch as the electrical resistivity decreases in both cases. The numerical data based on the theoretical model of discrete mode mixers along the cable and on experimental measurements involving 0.5 km long cables, with the pitch varied over the 80-200 mm range and the radius varied over the 2-5 mm range, can serve as references for optimizing the twist without exceeding permissible stress and attenuation levels. Figures 6; tables 1; references 3: 2 Russian, 1 Western.

[262-2415]

## ESTIMATING EXPECTED LIGHTNING DAMAGE TO CABLE LINE

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 29 Oct 83)  
pp 55-56

KHABIBULIN, V.M.

[Abstract] An exponential model is constructed, on the basis of numerous observations, for estimating the expected lightning damage to cable lines. The probability of the lightning current along the metal cable sheath exceeding the insulation breakdown level is accordingly defined as  $P(I_L > I_{bd}) = e^{-kI_L}$  ( $k = 0.04/kA$ ) and the permissible number of strokes (defects) per 100 km cable length in a year is determined accordingly from the general relation for the total number of strokes (defects)  $n = 2dLD_0 \int_0^Y e^{-kI} dy$  for any given region or locality ( $L$ - length of cable,  $d$ - number of strokes per  $km^2$  during a stormy day,  $D$ - number of stormy days in a year,  $Y$ - maximum distance from cable to site of stroke at which the latter will still cause damage). The lightning current is then expressed through surge voltage characteristics and insulation parameters, the latter lumped into an overall quality factor in terms of conductance to ground. For graph-aided cable design analysis and optimization, curves of insulation breakdown probability  $P$  as function of insulation breakdown voltage level  $V_{bd}$  and curves of breakdown probability ratio  $P_2/P_1$  as function of quality factor ratio  $G_2/G_1$  comparing two cables are plotted for various grades of earth in terms of its electrical resistivity. While all curves of the first set pass through the  $P=0$ ,  $V_{bd}=0$  point, all curves of the second set pass through the  $P_2/P_1=1$ ,  $G_2/G_1=1$  point.

Figures 2; references: 3 Russian.

[262-2415]

## SELECTIVITY OF FADEOUT ALONG SPANS OF RADIO RELAY LINKS CAUSED BY REFLECTIONS BY LAMINAR INHOMOGENEITIES IN TROPOSPHERE

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 17 May 84)  
pp 48-51

KALININ, A.A.

[Abstract] The effect of reflections by laminar inhomogeneities in the troposphere on the amplitude-frequency and phase-frequency characteristics of radio relay channels is evaluated as a stochastic process resulting from random variations of the refractivity in the troposphere and causing fadeout of signals through selective interference. The statistical analysis of this phenomenon is based on the two-beam model, for calculating the complex instantaneous electric field intensity  $E$  at the lower cutoff frequency  $f$  and at a frequency  $f + \Delta f$  within the pass band. The statistical

distributions of random fluctuations are then calculated for the attenuation factor  $V = E_f/E_0 = \sqrt{1 + \phi^2 + 2\phi \cos(2\pi f \Delta r/c + \arctan \phi)}$  ( $\phi$  - amplitude of reflection coefficient,  $\arctan \phi$  - phase of reflection coefficient,  $\Delta r$  - path difference between forward and reflected waves,  $c$  - speed of light in vacuum) and for the ratio  $X = V_f + \Delta f/V_f$  characterizing the nonuniformity of the channel frequency

characteristics, assuming a normal distribution of changes in the dielectric permittivity. Experimental data obtained over dry land (Great Lakes region in Canada) and over a coastal region (Atlantic coast in southwestern United States, Georgia) as well as over a 63.4 km long mixed land-sea route fit the theoretical fadeout curves quite closely, differences in the range of small  $X$  being attributable essentially to a multitude of reflected waves with small amplitudes rather than a single such wave actually appearing the receiver input. Figures 4; references 8: 4 Russian, 4 Western. [262-2415]

UDC 621.391.26

#### NOISE COMPENSATOR FOR MULTICHANNEL METER

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 28, No 9, Mar 85 (manuscript received 8 Sept 83) pp 84-85

POPOVSKIY, V.V.

[Abstract] In various radio engineering problems the necessity arises for conducting multichannel measurements, during which the vector of useful signals is observed on a background of noise with a uniform spectral density and narrow-band concentration interference. This paper considers the noise compensator for such a multichannel meter and the structural scheme of a compensation algorithm is illustrated and explained. Figures 1; references: 4 Russian. [267-6415]

UDC 621.391

#### CORRELATIONAL PROPERTIES OF LINEARLY MULTIPLICATIVE ARRAYS OF PHASE-KEYED SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 6 Dec 82) pp 313-316

VARAKIN, L.Ye. and SALNIKOV, Yu.K.

[Abstract] A new class of phase-keyed signals is proposed, as an improvement over known linear ones with respect to correlational properties as well as simplicity of sequence formation. An array of this linearly-multiplicative class is constructed on the basis of a linear array  $H$  by

selection of an arbitrary code sequence  $\{\alpha\}$  from the complete code of phase-keyed signals with base  $N$  ( $L = 2^k$ ,  $k = 0, N$ ) so that  $\{\alpha\} \in H$  and then symbol-by-symbol multiplication of each signal in array  $H$  by the "generating" signal  $\{\alpha\}$ . The correlation function of such a linearly-multiplicative array is evaluated in terms of the statistical moments of its distribution. An improvement is found not only in the statistical sense but also with respect to maximum peaks so that computer-aided analysis and synthesis do not require direct calculation of all correlation functions for estimation of mutual interference. References: 6 Russian.

[220-2415]

UDC 621.371

#### POSSIBILITIES OF TRANSFORMING DISTRIBUTION FUNCTION OF ATMOSPHERIC RADIO NOISE FROM BANDWIDTH TO BANDWIDTH ON BASIS OF GENERALIZING EMPIRICAL MODEL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 28 Mar 83) pp 396-399

OSININ, V.F.

[Abstract] The distribution function of atmospheric radio noise can be transformed from a narrow passband to a wide one. This method was successfully applied to experimental data on atmospheric radio noise in the regions of Cape Schmidt and Khabarovsk. The probability curves can be transformed with a large scale factor within the 1000-10,000 range, not only directly but also in two or three successive steps with the scale factor within the low range 1-100 and within the intermediate range 100-1000 respectively. The validity of such transformations is proved graphoanalytically in Rayleigh coordinates. Accordingly, narrow-band readings of station interference within medium-wave and short-wave ranges over the entire amplitude range anywhere in the Eastern USSR can be converted into data any combination of passbands based on reception requirements. Figures 4; tables 1; references 4: 3 Russian, 1 Western.

[220-2415]

UDC 621.391.821:621.396

#### RELATION BETWEEN AMPLITUDE-PROBABILITY DISTRIBUTIONS AND MEAN-OVERSHEW-FREQUENCY FUNCTIONS CHARACTERIZING ENVELOPE OF ATMOSPHERIC RADIO NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 6 Jun 83) pp 399-402

KABANOV, V.V. and KABANOVA, A.Kh.

[Abstract] The envelope of atmospheric radio noise, already characterized by the distribution of amplitude probabilities, can be additionally characterized by the mean frequency of overshoots. However, the model of

atmospheric radio noise proposed by H.N. Hall (Radioscience Laboratory, Stanford Electronic Laboratories, August 1966) for describing the mean-overshoot-frequency function does not fit experimental data gathered in the Eastern USSR over the 1981-82 period. The discrepancy can be removed by modification of the H.N. Hall model, where radio noise at the receiver output is represented as the product of a Gaussian process and a time-variable random weight function, namely by letting values of that weight function have an arbitrary rather than specific probability distribution. The resulting relation  $N(E) = \frac{\omega^*}{\pi} \int_0^{\infty} W_A(E \text{ Chz}) dz$  has been verified experimentally, with a special instrument simultaneously recording the mean-overshoot-frequency function and the increment of the integral envelope-probability-distribution function. Readings at 14 analyzer levels spaced 6 dB apart were supplemented with interpolating splines in a Rayleigh system of coordinates. Figures 2; references 9: 7 Russian, 2 Western (1 in Russian translation). [220-2415]

UDC 621.396

#### ZONAL RADIO COMMUNICATION WITH REMOTE REPEATER

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 13 July 1984) pp 7-9

GOLOVIN, O.V., ROZOV, V.M.

[Abstract] The paper considers the construction principles of a network of zonal shortwave radio communication with repeater point remote from the center of the zone by 2-2.5 thousand kilometers. It is concluded that available experimental materials demonstrate that use of repeaters for organization of a network of zonal radio communication solves the problem of transmission by this network of telephone and telegraph messages with high quality and reliability with a relatively large economy of energy as compared with a traditionally constructed network. However, it is necessary to subject a number of problems concerned with more complete use of the power of transmitting facilities or increased noiseproofing of radio reception in a network with repeaters to further investigation. Figures 3; references 4: 3 Russian, 1 Western. [257:6415]

UDC 621.396.982.6

COMPARATIVE ANALYSIS OF POTENTIAL NOISE IMMUNITY OF VARIOUS METHODS OF DIRECTION FINDING WITH CIRCULAR SCANNING

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 4 July 1984) pp 10-12

PER'KOV, V.V.

[Abstract] The paper conducts a comparative analysis of the potential noise immunity of the following methods of direction finding: 1) With respect to maximum signal without formation of sum-difference signal; 2) With respect to maximum sum signal; and 3) With respect to minimum difference signal. Figures 2; references: 3 Russian.

[257:6415]

UDC 621.373.423

CONCERNING THE STRUCTURE OF AN AUTODYNE SIGNAL

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 17 July 1984) pp 17-20

DUBININ, V.S. and TERESHCHENKO, A.F.

[Abstract] The object of this paper is to give a quantitative evaluation of the distortion of an autodyne signal as a function of the parameters of an autodyne, the level of an echo signal, and the magnitude of its delay, and on the basis of this analysis to develop a requirement for a low-frequency circuit treatment, as well as to determine the limiting possibility of autodyne measures of speed. An analysis is made of the output signal of autodynes, taking into consideration the delayed feedback. Relations are obtained which make it possible to determine the form and at the same time to evaluate the distortion of the autodyne signal. Criteria are developed for finding the parameters of an autodyne system which are necessary for an information regime. The frequency range and the limit of maximum frequency are determined, which it is possible to single out with the assistance of an autodyne, as well as the limiting distance below which information concerning speed disappears. The results obtained satisfactorily agree with an experiment conducted earlier. References: 13; 10 Russian, 3 Western.

[257:6415]

ENERGY CHARACTERISTICS OF NONSEARCH SIGNAL DETECTOR

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 18 Dec 84) pp 32-35

GLAZIN, Ye. F. and KRYUKOV, D.I.

[Abstract] The paper is concerned with determining the signal-to-noise energy ratio at the output of a signal detector (nonsearch with respect to frequency), based on combination Fourier processors; and with a comparative analysis with respect to analogous energy characteristics of matched filters. It is concluded that the signal-to-noise energy ratio of the signal detector considered in the paper is less than 3 db with respect to the optimum filter, matched with the signal, which is physically explained by the doubling of the spectral density of noise in the video frequency area with the input of a heterodyning mixture of signal with interference. However, use of band-pass filtering at the input of the device and an increase of the value of  $\omega_c$  (nominal value of signal frequency at output of mixer), and the value of an increase of the clock frequency of the search delay devices, makes it possible to eliminate the energy losses mentioned in the paper. Figures 1; references: 2 Western in Russian translation.

[257:6415]

CALCULATION OF CHARACTERISTICS OF DISCRETE CHANNELS WITH MEMORY, IN THE CASE OF A LONG LENGTH OF VECTORS OF ERROR

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 23 July 1984) pp 43-45

SHAPTSEV, V.A.

[Abstract] It is possible to conduct an analysis of discrete communication channels in a broad spectrum of probabilistic models of fading and characteristic memories on the basis of finite-dimensional characteristic functions (KKhF) of an imaginary argument of the square of the process of multiplicative distortions of a signal which has  $m$ -generalized distribution and its particular cases. However, with an increase in the dimensionality of the KKhF of the argument with respect to the exponent, the difficulty of calculations increases, even with the aid of an electronic computer. The present paper considers a variant of a partial solution of the problem of the computability of KKhF by calculation of the top estimate for it, which is obtained with smaller dimensionality of the argument. Figures 1; references: 4 Russian.

[257:6415]

UDC 621.391:621.391.837:621.397.63

HYPERTRIANGULAR DIGITIZATION OF n-DIMENSIONAL MESSAGES

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 13 Aug 1984)  
pp 49-52

BORODYANSKIY, A.A.

[Abstract] The problem is studied of optimum digitization of n-dimensional messages with a hyperrhombic region of limitation of the spectrum. The results are generalized as applied to n-dimensional messages with a given configuration of the region of limitation of their spectrum. It is shown that points of digitization must be arranged in units of the triangular lattice of a hyperplane message. By determining the possibility of limiting economical discrete presentation of messages, the results make it possible to evaluate the degree of technical perfection of systems for transmission of spectrozonal, color, stereoscopic, and other images. Figures 4; references: 6 Russian.

UDC 621.391.17

CALCULATION OF ALLOWABLE DISPLACEMENT OF OPERATING POINT OF ELECTROOPTIC MODULATOR IN DIGITAL SYSTEM OF INFORMATION TRANSMISSION

Moscow RADIOTEKHNIKA in Russian No 4, Apr 84 (manuscript received after revision 23 July 1984), pp 71-73

VIZNER, A.A.

[Abstract] A necessary condition for operation of high-speed systems for information transmission by an optical channel with external modulation is stabilization of the position of the operating point of the modulator, at a given section of the characteristics. In order to determine the requirements imposed on the stabilization circuit, it is necessary to evaluate the allowable displacement of the operating point of the modulator, at which the system characteristics are essentially not impaired. This paper presents a procedure for calculation of such an allowable displacement. Figures 2; references 8: 7 Russian, 1 Japanese.

[257:6415]

UDC 621.396.019.4

SENSITIVITY OF PHOTODETECTOR DEVICES WITH POISSON AND GAUSSIAN PHOTON STATISTICS

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 3 Apr 1984)  
pp 79-82

FEDOROV, V.B. and MITYAKOV, V.G.

[Abstract] The sensitivity is determined of photodetector devices which are used in optoelectronic memory and optical communication lines with uniform and biorthogonal encoding for photon statistics in a light beam. Sensitivity calculations are fulfilled for two forms of photon statistics, Poisson and Gaussian, with exponential distribution. In the case of Poisson statistics the results are obtained by numerical calculation on an electronic computer. Results characterizing the sensitivity of photodetector devices with exponential distribution of intensity are only used in communication systems with noncoherent (thermal) sources of radiation in those cases when the build-up time  $T \ll \tau_k$ , where  $\tau_k$  is the coherence time of the light wave. Figures 3; references 7: 5 Russian, 2 Western in Russian translation.

[257:6415]

UDC 621.391.1.019.3

EVALUATION OF EFFICIENCY OF WORK OF OPERATOR IN "MAN-MACHINE" SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 15 August 1984) pp 91-92

BORISOV, E.V.

[Abstract] The paper examines a method of evaluating the efficiency of work of an operator in a "man-machine" system, with the necessary initial data assigned in the form of imprecise sets. This makes it possible to formalize the subjective concept of an investigator with respect to appropriate characteristics of the system and operator, based on the stage of system design. Figures 1; references: 4 Russian.

[257:6415]

UDC 501.4.681.326.74

MODEL OF FUNCTIONAL DIAGNOSIS OF LINEAR DIGITAL SYSTEMS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 7, No 1, Jan-Feb 85  
(manuscript received 4 Jan 83) pp 61-66

DANILOV, V.V., ZHIRABOK, A.I., KOLESOV, N. V. and SHUMSKIY, A. Ye.

[Abstract] A procedure is proposed for synthesizing a system  $M_k$  in which all constant defects (class E) are detected in the synchronous linear system consisting of  $M$  and  $M_k$ . The approach is best applied to the class of single constant defects, inasmuch as one of the stages of the procedure entails modeling defective behavior. There is no need to expand the output vector  $M$  in order to synthesize the system  $M_k$  using the proposed algorithm.

References: 5 Russian.

[296-6900]

UDC 621.372.54

DYNAMIC NONLINEAR SIGNAL DISTORTIONS IN INPUT STAGES OF OPERATIONAL AMPLIFIERS IN ACTIVE FILTERS

Moscow ELEKTROSVYAZ in Russian No 3, Mar 85 (manuscript received 27 Jun 83)  
pp 57-60

IASLENNIKOV, V.V.

[Abstract] Dynamic nonlinear signal distortions in operational amplifiers with negative feedback, such as those used for active filters, are evaluated by an analytical method much simpler than the use of Volterra-Wiener series. This method is based on a model consisting of a differential input stage with piecewise-linear characteristics and infinitely high input and output impedances, followed by an inverting voltage amplifier with infinitely high input impedance and gain but zero output impedance, including a corrective feedback capacitor, and a voltage follower with piecewise-linear characteristic, infinitely high input impedance, unity gain, and finite output resistance at the end. The differential stage limits the maximum input current to the operational amplifier and the power supply

limits the follower output voltage. Signal distortions in the differential stage are calculated according to this model for a simple standard operational amplifier built with uZ 741 (second-generation) bipolar transistors. The performance of six different active filters with a single operational amplifier each is analyzed on the basis of this model. They are two low-pass filters, two high-pass filters, and two band-pass filters. In two of them an integrating circuit before the operational amplifier prevents occurrence of voltage step changes at the amplifier input and thus prevents overloading of the amplifier. In the other four the finite input impedance allows a voltage step increase to overload the input stage. For these four filters, the condition for overloading is established in terms of voltage level and the overload duration is calculated in terms of voltages and resistances. With the transfer function of each of the six filters given, the signal distortion is shown in the form of voltage-time characteristics. The latter are compared with oscilloscopes, the results indicating the significance of such parameters as amplifier output impedance usually disregarded in calculations of steady-state performance. The comparison also confirms the desirability of an integrating circuit before the operational amplifier for suppression of dynamic signal distortions. The author thanks A.K. Myasnikov for assistance in performing experiments. Figures 4; tables 1; references 8: 5 Russian, 3 Western (1 in Russian translation).

[262-2415]

UDC 621.396.96:621.391.26

#### EFFECTIVENESS OF DIGITAL RETUNABLE REJECTION FILTERS FOR MOVING TARGET SELECTION SYSTEMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 28, No 3, Mar 85 (manuscript received after revision 20 June 84) pp 14-18

KOZLOV, I.A. and MIRONOVA, T.V.

[Abstract] An analysis is made of digital retunable nonrecursive rejection filters which shows that as the optimum in a given class of filters it is possible to practice to use Chebyshev digital retunable rejection filters (TsPRF) of 1...4 orders. Calculation of the weight coefficients of TsPRF is conducted according to the simple analytical relations presented, on the basis of the width of the spectrum and the Doppler frequency of the noise, without use of the laborious computing procedure of optimizing coefficients on a digital computer. The filters are constructed on a feedforward basis and from the standpoint of a transient condition have known advantages as compared to adaptive filters with correlation feedback. Figures 3; tables 2; references 7: 5 Russian, 2 Western.

[267-6415]

UDC 621.372

DYNAMIC RESPONSES OF SYSTEMS FOR PRELIMINARY SPATIAL TREATMENT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received after revision 10 July 84) pp 18-21

VLASENKO, V.A., KRYLOV, V.N.

[Abstract] The dynamic responses are analyzed of a simplified model of a system of preliminary spatial processing of achromatic and color images which provides the basis for construction of special and video processors for preliminary treatment of images. The model contains spatial filters of arbitrary structure which satisfy the condition of separability. Test signal representation is the product of combinations of exponents. Such a model of test representation makes it possible with high precision to approximate any two-dimensional smooth periodic function. Figures 3; references 6: 4 Russian, 2 Western in Russian translation.

[267-6415]

UDC 621.391.2

DESIGN OF FILTERS WITH INTEGRAL DATA INPUT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received 28 May 84) pp 22-26

YURCHENKO, Yu. S.

[Abstract] An approximate method of planning algorithms for filters with integral data input is described. This makes it possible to simplify the equations for the dispersion matrix and an optimum amplification factor. The possibility is shown of obtaining an evaluation of the error of the approximate solution without fulfillment of a precise calculation, and of determining the boundaries containing a precise solution. Figures 3; references: 4 Russian.

UDC 681.518.3

ALGORITHMS FOR STATISTICAL ANALYSIS OF MULTIDIMENSIONAL RADIO ENGINEERING SYSTEMS WITH RANDOM PARAMETERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received after revision 30 July 84) pp 26-30

MAYKOV, K.A. and TEREKHOV, V.A.

[Abstract] Expressions are obtained which make it possible to construct an algorithm for calculation of the static moments of arbitrary order for models of multidimensional radio engineering systems with random parameters, where in the general case the calculation error is determined by the number of iteration loops. References: 4 Russian.  
[267-6415]

UDC 621.391.266

NONLINEAR FILTRATION OF ELLIPTICALLY POLARIZED IMPULSE SIGNAL

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received 5 Jan 84) pp 72-74

LOGVIN, A.I.

[Abstract] In this paper a block diagram (briefly described but not shown) of the receiver of an elliptically polarized impulse signal is synthesized by the methods of the Markoff theory of nonlinear filtration. References: 8 Russian.  
[267-6415]

UDC 621.372.543.3

CONSTRUCTION OF BAND-ELIMINATION SYNCHRONOUS FILTERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received 16 Feb 84) pp 77-79

CHEKH, A.V.

[Abstract] The paper describes band-elimination RC-synchronous filters (RCF) of the second order, constructed on the basis of a switching RC-filter of upper frequencies (high-pass filter) which has a low depth, frequency band, and discrimination of elimination. The large depth of elimination in the RCF is attained by the use of circuits for selection and stabilization of the level and increase of the pulse duty factor for the switching pulses

of the capacitors, or in the circuit of the RCF of the second order constructed on the basis of subtraction with respect to the value of the resonance frequency of the output and input voltages of a band-pass RC-synchronous filter. For an increase of the frequency band and discrimination of elimination, it is necessary to construct RCF of higher orders, which it is possible to realize with the use of active elements without frequency-sensitive feedback or with frequency-dependent feedback. Figures 4; references: 4 Russian.

[267-6415]

UDC 621.391:621.396.67.01

## PERFORMANCE OF SPACE-TIME FILTER IN PROCESSING WIDEBAND SIGNALS

Moscow RADIOTEKHNika I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 24 Mar 83) pp 317-323

DANILEVSKIY, L.N., DOMANOV, Yu.A. and KOROBKO, O.V.

[Abstract] The performance of a space-time filter for wideband signals is analyzed, after such a filter has been synthesized on the basis of a linear equidistant antenna array with K taps from each of its N elements. Synthesis of such a filter proceeds in two stages, first in the frequency domain and then in the time domain. In the first stage one obtains a radiation pattern with prescribed characteristics at various frequencies within the signal band and controls the locations of its null points by a method similar to the Lewis scheme with only  $2(N-1)^2$  instead of  $N^3$  multiplications for calculation of the weight factors for all  $N-1$  nulls. In the second stage the weight factors are recalculated in the time domain, with the aid of data on the interference energy spectrum. The performance of such a filter has been evaluated for Gaussian stationary input signals with a rectangular envelope of the power density spectrum. A linear equidistant antenna array of  $N=11$  elements was used as model of such a filter, first without and then with a delay line on each element for suppression of wideband interference. The degree of interference suppression depends not only on the magnitude of the time delay but also on the number K of taps per antenna element, which in this study was varied from 7 to 17. Figures 6; references 9: 3 Russian, 6 Western.

[220-2415]

UDC 621.372.2

NONCAUSAL FILTER BASED ON CHARGE-COUPLED DEVICES

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 16 July 1984) pp 35-37

BOGOSLOVSKIY, A.V., MIROSHNICHENKO, S.I. and YAKOVLEV, V.N.

[Abstract] This paper is concerned with solving the problem of increasing the contrast of the fine structure of the components of television images where suppression of the lower spatial frequencies is used, which is accomplished by transmission of the image signals through low-frequency filters and subsequent subtraction of the result of the processing from the original video signal. In order to assure noncausalness with a comparatively small power consumption, mass, and overall dimensions, a low-frequency filter is proposed, based on devices with charge coupling, with nondirectional transfer of charge. This filter is described as characterized by compactness, simple technical realization, and the ability to conduct processing of signals in a real time scale. Figures 1; references: 4 Russian (1 based on nonRussian data).

[257:6415]

UDC 621.396.621.52

EFFECT OF PARAMETERS OF SIGNAL SOURCE ON LINEARITY OF DIODE DETECTOR

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 11 July 1984) pp 37-39

SIMONOV, Yu.L., YAMNITSKIY, V.A. and SIMONOV, A. Yu.

[Abstract] An evaluation of the linearity of a detector described in a previous paper by A. Yu. Simonov (RADIOTEKHNIKA 1983, v.36, No 12) was completed without allowing for the effect of the detector's radio-frequency amplifier. The present paper demonstrates that the internal resistance of this amplifier substantially affects the magnitude of the distortion factor. The nature of the affect depends on the choice of the parameters of the detector circuit. Methods are obtained for computing the distortion factor and the resulting detector characteristics of the detector and amplifier. Figures 2; references: 2 Russian.

[257:6415]

UDC 621.396.06

DIGITAL MODELLING OF RADIHOLOGRAM OF NONSTATIONARY INHOMOGENEOUS OBJECTS

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 16 July 1984) pp 77-78

BELOUSOV, N.A., CHERNYSHOV, Ye.E. and SHCHENNIKOV, M.I.

[Abstract] The high resolution of coherent radio systems based on holography principles, in conjunction with contemporary means of space-time processing, makes it possible to detect objects in space, not only of coordinates but also of geometrical and electrical parameters. This paper examines a discrete algorithm for forming a radiohologram on the basis of a phenomenological model of a nonstationary inhomogeneous object. The conditions are determined for the applicability of the algorithm and its effectiveness in various situations. References: 4, 3 Russian, 1 Western in Russian translation.

[257:6415]

UDC 621.372.543.2

TUNABLE ACTIVE BAND-PASS FILTER

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 23 July 84) pp 83-85

POPOV, V.B.

[Abstract] The construction is described of a tunable active band-pass filter with adjustable circuit elements, and the precision characteristics of the filter are examined. This filter was used in a system for collection of data from a seismic prospecting complex, together with a system of automatic tuning at an operator's signal. The range of the operating frequency amounted to 10-80 Hz. Figures 3; references 5: 3 Russian, 2 Western.

[257:6415]

UDC 621.396.96.538.3

INDETERMINACY FUNCTION OF SIGNAL SCATTERED WITH RESPECT TO THREE PARAMETERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 21 Jun 84) pp 13-20

ZHUKOVSKIY, A.P., KOSTROMINA, N. V. and NUZHIN, V.M.

[Abstract] An expression is obtained for the indeterminacy function of a space-time signal on the basis of the electrodynamic model of radiowave reflection from an extended surface. The influence of the surface characteristics, the parameters of the antenna system, and the sounding signal on the properties of the indeterminacy function are investigated. The parameters of the generalized indeterminacy function (the effective width and the position of the maximum in different cross-sections) are found as a function of the geometric and statistical parameters of the reflecting surface, as well as the parameters of the sounding and reference signals and the receiving antenna. The position of the maxima is found to be directly proportional to the height of the large irregularity, and the variance of the direction cosine depends upon the variance of the height of large irregularities, increasing with the latter. The findings can be used to select the most effective parameters for the antenna system and the modulation of the sonic signal, as well as to assess the potential capabilities of multiposition measurement systems. Figures 2. References: 6 Russian.  
[287-6900]

UDC 537.876.001.24

DESIGN OF ELEMENTS OF QUASI-OPTICAL LINE FORMING ASSIGNED RADIATION PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 27 Dec 83) pp 647-652

TKACHUK, V.P.

[Abstract] A quasi-optical line whose elements consist of the formation of a prescribed radiation pattern is analyzed for a system in which the quasi-optical elements are small-period lattices. The coefficients of reflection

and transmission that produce the required radiation pattern are found from the transparency parameter, which varies along the lattice. Discrete distributions of the transparency are examined, in addition to arbitrary continuous distributions and continuous distributions with constraints. A group of FORTRAN programs that implement the proposed algorithm are described. Quasi-optical lines consisting of 4 and 10 elements are calculated as examples. The influence of constraints on the transparency parameter of the lattices is investigated, and the effect of increasing the number of elements in the line is studied. Figures 4. References: 4 Russian.  
[285-6900]

UDC 621.391.81.001.24

#### AVERAGE UHF FIELD STRENGTH IN CITIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 15 Sep 83) pp 678-683

PONOMAREV, G. A. and KULIKOV, A. N.

[Abstract] The average urban UHF field strength is calculated using the approximation of single wave scattering on a set of large randomly placed objects. Communications between two points are analyzed: one with the antenna elevated above the roofs of the buildings, and the other placed close to the ground. Findings are obtained for distances shorter than the visible horizon. It is found that calculating the UHF field above an urban structure with allowance for shielding makes it possible to obtain results that agree with experimental findings with respect to range, the altitude of the observation point, and frequency. Figures 4. References 6: 4 Russian, 2 Western.  
[285-6900]

UDC 621:315(201)

#### EFFICIENCY OF ENERGY TRANSMISSION BY ELECTROMAGNETIC BEAM AND CONVERSION IN RECTENNA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 12 May 83) pp 805-811

YEGOROV, A.N.

[Abstract] A general expression is derived for the efficiency of energy transmission by an electromagnetic beam and for converting that efficiency to direct current in a rectenna. Conditions are found for minimum energy loss in the electromagnetic transmission line. Conditions for ideal direct current matching of rectenna elements are identified. The influence of the field distribution on the apertures on the efficiency of the electromagnetic

transmission line is analyzed. The conditions are identified that must be satisfied in order to achieve maximum efficiency. The form of the optimum distribution of the field incident on the rectenna depends upon the way in which the rectified current is picked up in the rectenna. Figures 3. References 10: 7 Russian, 3 Western.  
[285-6900]

UDC 621.391

#### INTERFERENCE NOISE IN QUADRATIC SIGNAL RECEPTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 4, Vol 30, Apr 85 (manuscript received 15 Mar 83) pp 815-818

MERKISHIN, G. V.

[Abstract] The level of the fluctuating signal component (interference noise) in quadratic signal reception is investigated. Two receiver versions are considered: one with the quadratic detector at the focus of the receiving antenna, and one with a quadratic detector having a highly photosensitive surface located in the Fourier plane of the optical system, with the detector output signal consisting of the integral of the distribution of the field of intensity over the photosensitive surface. The receiver with the quadratic detector in the Fourier plane provides a better ratio between the constant and fluctuating components of a signal reflected from a set of scintillating points. Increasing the area of the receiving aperture reduces the influence of the interference component. The relationship and signal/noise ratios obtained can be used to make a fast estimate of the strength of the interference noise. Figures 2. References: 2 Russian.  
[285-6900]

UDC 621.396.677:681.5.015

#### KALMAN FILTERING OF SIGNALS IN ADAPTIVE ANTENNA ARRAYS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian Vol 28, No 3, Mar 85 (manuscript received after revision 31 July 84) pp 9-14

PRESNYAKOV, I.N., SYTKOV, O.V.

[Abstract] An algorithm is proposed for resolution and tracking of moving bodies, the angular distances between which is less than half the width of the major lobe of the antenna's directional pattern. The algorithm considered makes it possible to obtain a dynamic evaluation of a three-dimensional spectrum without a significant increase of the requirements for a high-speed response of digital processors, by means of the use of information received in the process of self-instruction or a priori information. At the same time

the gain in the speed of response is obtained at the cost that inversion of the correlation matrix is only performed with the object of assigning initial conditions for a filter-extrapolation and subsequent correction of the model. If the model of source movement is selected incorrectly, the quality of operation of the proposed algorithm is no worse than that of an algorithm of "thermal noise." Figures 3; references 9: 6 Russian, 3 Western (1 in Russian translation).

[267-6415]

UDC 621.391.2

#### SYNTHESIS OF NOISE TOLERANCE OF AGC SYSTEM

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian  
Vol 28, No 4, Apr 85 (manuscript received 10 Oct 84) pp 3-8

SAVCHENKO, V.V.

[Abstract] A noise automatic gain control method based on a first-order nonstationary stochastic approximation algorithm is proposed. The adaptive algorithm normalizes the interference with respect to power to a given constant level by using negative feedback. The approach provides good noise tolerance while retaining the dynamic properties required for radar operation. The findings can be used to assess the comparative effectiveness of the synthesized system and the classical AGC version using the same gains in the feedback circuit. The synthesized system also provides better protection against powerful pulse interference, which is a serious problem for receivers with stabilization of the false alarm probability. Figures 4.

References 12: 11 Russian, 1 Western.

[287-6900]

UDC 621.396

#### PULSE-PHASE METHOD OF RANGE MEASUREMENT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODELEKTRONIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received 14 May 84) pp 49-52

PAKHOMOV, Yu.N., RYNDYK, A.G.

[Abstract] Pulse and phase methods of measurement are widely used in radar systems for determining range. The present paper describes a combined pulse-phase method. In so doing, precise measurement of range is assured by the pulse method, and the phase method is used for elimination of measurement ambiguity. With an increased repetition frequency of the transmitter pulse, the impulse-phase method makes it possible to assure unambiguous measurement of the range to the target. Estimates are made of the quality of doppler

selection and the reliability of measurement. The results obtained also remain correct in the case where the transmitter pulses have an intrapulse modulation, regardless of its concrete form. Figures 3; references: 4 Russian.  
[267-6415]

UDC 537.874.6.047

## RAYLEIGH'S HYPOTHESIS AND ANALYTICAL PROPERTIES OF WAVE FIELDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 16 May 84) pp 193-210

APELTSIN, V.F. and A.YURKCHAN, A.G.

[Abstract] Application of the Rayleigh hypothesis to problems of diffraction is overviewed, such problems being mathematically formulated in accordance with a classical theory and their solution in accordance with this hypothesis being sought in the form of an infinite linear combination of elementary waves (plane, cylindrical, spherical) propagating in only one of possible directions. As an elementary wave is defined a particular solution to a homogeneous steady-state wave equation in free space in any given curvilinear orthogonal system of coordinates. Diffraction of the wave field of a point source by a completely bounded region is considered first, and the corresponding problem is formulated according to the two-dimensional classical theory with Dirichlet boundary condition. Next are considered diffraction of waves by a single scatterer and scattering of waves by a surface with periodic structure. The solution to such problems is examined for singularities in wave fields and for validity of the Rayleigh hypothesis. This leads to a theory of reverse problems of diffraction and conditions for their solvability. It also leads to unconventional formulations of such problems as finding the distribution density of sources or currents spread over curves completely inside the scattering body and finding the diffraction field and the distribution of sources from the known scattering or radiation pattern generated by that distribution when the latter is a localized one. While the validity of the Rayleigh hypothesis, of the Sommerfeld integral, or simple and double layers in these two problems has been analytically tested in few instances only, numerical methods of solution have been used extensively. Among them are the Waterman method, its Masel-Merril-Miller modification, the Barantsev method, and regularization of Rayleigh series. Noteworthy are the yet to be resolved contradiction between completeness of metaharmonic Hankel functions on any Lyapunov contour in the case of non-Rayleighian scatterers, and the incorrectness but adequate accuracy of the Rayleigh method for configurations with supercritical values of geometrical parameters. References 54: 26 Russian, 28 Western (3 in Russian translation).  
[220-2415]

SYNTHESIS OF CLOSED PLANE ANTENNA FOR PRESCRIBED RADIATION AMPLITUDE PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 84 (manuscript received 21 Feb 84) pp 276-281

ANDRIYCHUK, M.I. and VOYTOVICH, N.N.

[Abstract] Synthesis of a closed plane antenna for a prescribed radiation amplitude pattern is considered, and a criterion is established for regulating the mean-square deviation from that pattern through the current norm with a free weight factor. A positive real function is defined which the amplitude pattern of the synthesized antenna should approach, whereupon the current distribution is sought which will minimize the error dispersion functional. The problem can be solved as a variational one by successive approximations, beginning with the Hato derivative as first variation. The iteration process is simplified by evaluation of the pattern function according to an explicit formula rather than solution of the resulting nonlinear nonhomogeneous integral equation on each step. The problem can also be solved by direct minimization of the functional, most expediently with application of gradiental methods. A modification of conjugate gradients which reduces the problem to a system of three nonlinear algebraic equations is shown to be somewhat faster than the Fletcher-Reeves method and much faster than steepest descent. Calculations have been made for elliptical antenna arrays with various eccentricities, including the extreme case of zero eccentricity or circular array. Figures 4; references: 12 Russian. [220-2415]

DETERMINING COORDINATES OF LOCAL INHOMOGENEITIES ON SURFACE OF OBJECT FROM BACKSCATTERING AMPLITUDE-PHASE PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 23 Oct 81, after correction 25 Feb 83) pp 282-290

MANUKYAN, A.A.

[Abstract] The space coordinates of local inhomogeneities on the surface of an object and thus the parameters of an object's rotational motion are estimated from the backscattering amplitude-phase pattern, according to the method of reverse aperture synthesis and simultaneous processing of Doppler portraits shifted in time. The necessary formulation of a sample estimate of the amplitude spectrum within a narrow sector  $\Delta \theta$  of the amplitude-phase pattern is based on an appropriate one-dimensional portrait. A portrait in the form of a superposition is considered and found to be peaking when constructed from backscattering at angles far off specular reflection angles for arrays of point inhomogeneities, but to be spread over an interval which

corresponds to the characteristic dimension of a distributed local inhomogeneity when constructed at angles close to specular reflection angles. For construction of a two-dimensional portrait one can use a set of one-dimensional portraits corresponding to narrow sectors shifted from one another in aspect, which is demonstrated in the case of peaking one-dimensional ones. Replacement of Fourier transformation with Fresnel transformation will yield a two-dimensional portrait from a given direction, which is useful only in the case of sufficiently large  $\Delta\theta$  and correspondingly high longitudinal resolution. The accuracy of this method is characterized by the fluctuation error of radius-vector measurement, measurement of its two orthogonal components in a plane, and by the attainable resolution. Analytical expressions for both accuracy parameters are derived on the basis of the applicable geometrical relations. The author thanks A.A. Kuriksha and V. D. Shilin for helpful suggestions and for discussion of the results. Figures 1; references 10: 8 Russian, 2 Western (1 in Russian translation).  
[220-2415]

UDC (621.396:621.391)551.463

#### IMPROVING ACCURACY OF RADAR MEASUREMENTS OF ICE CAP THICKNESS ON SEA BY CEPSTRAL PROCESSING OF REELECTED SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 25 Mar 83) pp 291-297

BOGORODSKIY, V.V., BOYARSKIY, V.I. and OGANESYAN, A.G.

[Abstract] Radar probing of ice caps on sea requires measurement of thicknesses as small as 15-20 cm, for which probing pulses of 2-3 ns duration are needed. Because of the limited resolving power of a radar, one way to determine the time interval between successively arriving signals reflected by top and bottom surfaces is using indirect indicators. This method is subjective and cannot be automated. A better way is digital inverse filtration of reflected signals as, for example, by cepstral processing. Without a Rayleigh time resolution between probing and reflected signals, however, this is practical only under certain conditions. The purpose of cepstral processing is to extract the pulse response characteristic of the probed medium, in this case ice, which carries information about the time delay from upper reflection to lower reflection. The possibility of improving the accuracy of cepstral processing and thus extending the applicability of this method has been examined on the basis of model experiments with a digital simulator of signals for ice layers of various thicknesses. Two electrical properties of ice, namely the real part of its dielectric permittivity and the specific absorption of electromagnetic energy, were first assumed to be constant over the frequency spectrum of the probing signal and then allowed to vary as functions of the frequency separation between harmonics in the probing signal. Best results were obtained by using a filter with a frequency characteristic inverse to the frequency spectrum of the probing signal. The feasibility was subsequently confirmed by physical experiments with radar probing of the ice cap in the Eastern Arctic region from an IL-14 airplane

during the February-April 1983 period. Figures 5; tables 3; references 7: 4 Russian, 3 Western (1 in Russian translation).  
[220-2415]

UDC (537.876:551.510.5)001.57

STATISTICAL MODELING OF RADIATION ENERGY RECORDED BY RECEIVER AFTER PROPAGATION THROUGH TURBULENT ATMOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 28 May 82) pp 298-305

KIRAKOSYANTS, V.Ye. and LOGINOV, V.A.

[Abstract] The statistical characteristics of laser radiation propagating through a turbulent atmosphere are determined on the basis of signal energy fluctuations in the photoreceiver. Direct detection through a lens system and an optical filter is considered, with the area of photosensitive surface sufficiently small to limit the power of ambient radiation. The probability density of signal energy fluctuations is calculated for such a photodetector, assuming a log normal distribution of the random quantity  $e^{2x_0}$  and thus a moderate number of correlation spots. It is also assumed that fluctuations of the  $\chi_j(r)$  level remain independent of the phase front. The integral distribution law of the random quantity  $R_c$  which characterizes space processing of the received signal is calculated in the approximation of a diffraction parameter much larger than unity, one smaller than unity not being feasible in the presence of quantum noise and one only slightly larger than unity requiring a very small aperture. The correlation functions as well as the structural amplitude and phase functions are evaluated by the method of smooth perturbations, in the first approximation of a uniform isotropic field in the aperture. Figures 1; references: 2 Russian.

[220-2415]

UDC 537.52.001.24

CONDITIONS FOR ABSENCE OF DISCONTINUOUS OSCILLATIONS IN 'POSITIVE COLUMN - METAL ENVELOPE' DISCHARGE SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 1 Dec 83) pp 346-350

KONENKOV, N.V., MELEKHIN, G.V. and STEPANOV, V.A.

[Abstract] Oscillations in a "positive column - metal envelope" discharge system are analyzed for stability, considering that resistors connected into both anode circuit and cathode circuit stabilize the discharge. The system is necessarily regarded as one with distributed impedance components. It is

treated on this basis as a long reciprocal transmission line between a generator shunted by the anode resistance at the input end and the cathode resistance as load at the output end, with generator gain equal to line attenuation. The corresponding wave equation splits into a system of two equations, which are tested for absence of positive roots. This establishes the upper bound for the length of the discharge system or its equivalent transmission line, thus also the necessary condition for absence of discontinuous oscillations. Cathode resistance and anode resistance are assumed to be equal, for simplification. The theoretical results have been verified experimentally, impedance measurements also confirming that such a system is a distributed one. Figures 5; references 4: 2 Russian, 2 Western (1 in Russian translation).

[220-2415]

UDC 537.8

#### SYNTHESIS OF SOURCES TO PRODUCE RESONANCE FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 4 May 83) pp 387-390

ANTONOV, V.A. and KLOKOV, V.I.

[Abstract] A resonant source is synthesized to produce a periodic electromagnetic field whose electric and magnetic intensities in complex vector notation remain proportional to one another in the same ratio at all points in space outside that source. The problem is solved mathematically by first considering an inner region within which displacement of charges at a frequency  $\omega$  can result in oscillation of charges with a density  $\rho$  and the corresponding outer region  $G$  where the conditions of resonance will be satisfied. It is rigorously demonstrated, with use of the Poynting vector, that under this condition  $\mathbf{H} = \frac{1}{Z} \mathbf{E}$  the proportionality factor relating both field intensities can have only one of two possible values:  $Z = \pm Z_0$  ( $Z_0 = \sqrt{\mu/\epsilon}$  - characteristic impedance,  $i = \sqrt{-1}$ ). The problem of synthesis is then solved by introducing vector potential  $\mathbf{A}$  and scalar potential  $\phi$  related through the Lorenz constraint  $\text{div } \mathbf{A} + i\omega\phi = 0$  and calculating them from the corresponding Helmholtz equation for each. An analysis of the solution yields the necessary and sufficient condition for existence of such sources, namely when and only when the current distribution in the outer region  $G$  is  $\mathbf{j} = \text{curl } \bar{\mathbf{C}} + k\bar{\mathbf{C}}$  with vector-function  $\bar{\mathbf{C}}$  equal to zero at the boundary between both regions and arbitrarily finite everywhere else. One specific example is a vector-function  $\bar{\mathbf{C}} = (0, 0, 1)$  inside a unit sphere and equal to zero outside that sphere. Another example is a vector-function  $\bar{\mathbf{C}} = (0, 0, 1)$  inside a cylinder of unit radius and finite height and zero outside that cylinder. References 3: 2 Russian, 1 Western (in Russian translation).

[220-2415]

UDC (537.876:551.510.5)029.7

FLUCTUATIONS OF POWER RECORDED BY RECEIVER AFTER PASSAGE THROUGH TURBULENT ATMOSPHERE ALONG PATH WITH REFLECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 11 Jan 84) pp 390-392

BELOV, M.L. and ORLOV, V.M.

[Abstract] Fluctuations of power recorded by a photodetector after passage from a noncoherent source through a turbulent atmosphere with reflection by a strongly scattering surface along the path are evaluated in terms of their relative dispersion. The exact expression for this statistical parameter can, in most practical cases, be simplified to  $F \approx 1.41 \sqrt{S}^{-7/6} q^{-2}$  ( $\sqrt{S} = S^2/r_0^2$ ,  $q = kr_0^2/L_{SS}$ ,  $\pi S^2$  - area of bright spot,  $r_0$  - coherence radius of plane wave in first approximation of the "smooth perturbations" method,  $L_{SS}$  - distance from source to scattering surface,  $k = 2\pi/\lambda$  - wave number). References: 4 Russian.

[220-2415]

UDC 621.396.67.01

SYNTHESIS OF PASSIVE DIPOLE ARRAY WITH 'LOBELESS' RADIATION PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 17 Jan 84) pp 392-393

MIKHAYLOV, M.Yu. and CHAPLIN, A.F.

[Abstract] The synthesis of a rectilinear array of passive dipoles with a "lobeless"  $\Phi(\phi) = \sin^8 \frac{\phi}{2}$  radiation pattern is shown. Calculations have been made by numerical methods on a high-speed computer, according to an electrodynamic model in which  $N$  thin ideally conducting dipoles, only one dipole active and all  $N-1$  others passive, are spaced along a straight line parallel to one another and thus identically oriented. As the target function was selected

$$\Psi = \min_{\{d_i, \phi_i\}} \max_{\phi = 75^\circ, 180^\circ} \frac{\Phi(\phi)}{\Phi(0)}, \quad i = 1, 2, \dots, N \text{ so as to minimize side lobes within the } 75^\circ-180^\circ \text{ sector and maximize the major lobe in the } \phi = 0 \text{ direction of the array axis. Figures 3; tables 1; references: 4 Russian.}$$

[220-2415]

UDC 621.372.8.01

EFFECT OF NARROW ANNULAR SLIT IN CIRCULAR MULTIMODE WAVEGUIDE ON PROPAGATION OF SYMMETRIC ELECTRIC WAVES THROUGH LATTER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 21 Feb 84) pp 393-396

LAPTA, S.I. and MISYURA, N.N.

[Abstract] Propagation of  $E_{0n}$ -mode waves through a circular multimode waveguide with a narrow annular slit or barrier is analyzed by the "given field" method. The scattering matrix for such a wave and such a slit is evaluated over the entire frequency range, including the vicinities of cutoffs. A longitudinal  $E_{0n}$ -mode wave ( $n = 1, 2, \dots$ ) is assumed to strike the barrier while propagating through the waveguide in one direction. The field distribution over the slit is given as that of an electrostatic field  $\xi(z) = \xi^+(z) + \xi^-(z)$ , with the unknown coefficients for both components determined from averaged and weighted boundary conditions according to the theory of residues. A comparison with analogous results for  $H_{0n}$ -mode waves reveals that an annular slit or barrier influences the propagation of  $E_{0n}$ -mode waves much more, except in the vicinities of cutoff frequencies where it influences them less. Figures 2; references 6: 4 Russian, 2 Western.  
[220-2415]

UDC 510.5:621.391.26

PLANNED PROCEDURE FOR ANALYSIS OF EFFECT OF MULTIPATH PROPAGATION ON THE CHARACTERISTICS OF DETECTION OF SIGNALS AT RADAR STATION

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 31 July 1984) pp 13-17

DOMAKOV, V.V., KADULIN, V. V.Ye., and REZBANOV, D.M.

[Abstract] A planned procedure is proposed which makes it possible to conduct an analysis of the effect of multipath propagation on the operation of the characteristics of detection of signals at a radar, and to synthesize in an automated design system an optimum system of space-time processing. The possibility is shown of improving the characteristics of a multielement antenna, selecting a distance between the elements, at an optimum connected with the delay between the beams  $\Delta$  and the width of the band of the signal  $\omega_c$ , and in the case where a multielement antenna is used in the receiving device, improving proportionally  $k$ , i.e., the number of elements in the antenna. Figures 3; references 2: 1 Russian, 1 Western in Russian translation.  
[257:6415]

PROBABILITY DISTRIBUTION OF AMPLITUDE FLUCTUATIONS OF RADIO SIGNALS IN HIGH-ALTITUDE IONOSPHERE

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 6 July 1984) pp 64-67

SOLODOVNIKOV, G.K., RUSSKIN, V.M., and CHEREMNYY, V.A.

[Abstract] The paper examines the problem of a probability model of the fluctuations of radio signals passing through the ionosphere. In order to determine the possibility of an approximation of the distribution of the amplitude of signals, a check was made of the agreement of empirical distributions obtained during processing of the amplitude fluctuations of the signals of the earth satellite series "Transit" with the  $m$ -distribution of M. Nakagami (Statistical Methods in Radio Wave Propagation, Pergamon, N.Y., 1960) with the aid of the agreement criterion of Kolmogorov-Smirnov. The results obtained lead to the conclusion that Nakagami's distribution can simply and easily describe the fluctuations of the amplitude of signals, and the parameters of distribution can be modelled and have an established regularity of behavior during changes of geographical conditions. Figures 2; table 2; references 4, 3 Russian, 1 Western.

[257:6415]

METHOD OF CALCULATION OF MAXIMUM OBSERVABLE FREQUENCY WITH DOUBLE-SHOCK PROPAGATION OF DECI METER RADIO WAVES

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received after revision 23 July 1984) pp 67-70

AGARYSHEV, A.I.

[Abstract] When choosing the parameters of a communication channel and in direction finding, it is advisable to know the maximum frequency of propagation, with two reflections from the F2 ionospheric layer (maximum observable frequency-2 [MOF-2] on the ionogram of inclined sounding presented in the paper). However, calculation of this frequency by the widely prevalent method of equal shocks leads to significant systematic errors. This paper proposes a more precise method of calculating MOF-2, taking into account a number of distinctive features of double-shock propagation in comparison with one shock. Figures 4; references 8: 7 Russian, 1 Western.

[257:6415]

QUANTUM ELECTRONICS, ELECTRO-OPTICS

UDC 621.373.826

ANALYSIS OF THE INFLUENCE OF ABERRATIONS ON FORMATION OF LASER RADIATION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 8 Aug 84) pp 61-65

KLIMKOV, Yu. M. and KUZMINA, T.I.

[Abstract] The influence of aberration on the far-zone energy structure of a confined basic-mode laser beam is investigated. The analysis is done by applying diffraction theory to the last (output) component, representing the aberrations of the optical system in wave form. The influence of wave spherical aberration on the far-zone intensity distribution of a Gaussian beam formed by a component whose mount confines the beam is examined as an example. It is found that the combined action of aberration and confinement changes the energy structure of the beam significantly: the amount of radiated energy contained within the specified normalized radius is reduced, which increases the energy divergence. As the confinement increases, the influence of aberrations becomes greater. Figures 2. Table 1. References: 4 Russian.

[296-6900]

UDC 535.317.2

DESIGN METHODS FOR OPTICAL LASER FOCUSING SYSTEMS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 21 May 84) pp 65-70

IVANOV, P.D., KALININA, O. D., KOKORIN, N. Ye., NATAROVSKIY, S. N. and SUKHORUKOV, S. K., Leningrad Institute of Precision Mechanics and Optics

[Abstract] The authors address a number of issues associated with the focusing of laser radiation: obtaining the required light distribution over the focused light spot, the influence of the mode structure of the laser beam on the light distribution, and the accuracy of the approximate solution of the problem based on the fact that the largest focusing spot is obtained

in the rear focal plane of the focusing optical system. Different designs of optical layouts for focusing laser radiation are compared and analyzed uniformly by reducing them to a single-component equivalent system. The characteristics of the dimensional analysis of the systems and their constraints are investigated. It is found that the information contained in the laser certificate (the beam divergence and diameter) is not enough to permit the exact analysis method to be used, but that the solution obtained by the first of the approximate methods provides a result close to the precise one. Figures 1. References: 8 Russian.  
[296-6900]

UDC 778.417:771.537.61

#### RESOLUTION PARAMETERS OF RASTER SYSTEMS FOR REPRODUCING THREE-DIMENSIONAL IMAGE

Moscow TEKHNIKA KINO I TELIVEDENIYA in Russian No 4, Apr 85 pp 9-11

IGNATYEV, N.K., All-Union Scientific Research Motion Picture Photography Institute

[Abstract] An approach is developed for estimating the resolution parameters of a three-dimensional image obtained by various discrete synthesis methods which has the advantage that it allows for the characteristics of the transmission of the discrete light beams in the reproducing system that creates the illusion of three-dimensionality. The reproduction process alone is examined, disregarding such preceding operations as photographing, projecting, or printing. The resolution parameters are determined only in the horizontal measurement, which is most important for reproducing three-dimensionality. Lens-raster parallax-panoramogram reproduction is compared with mirror-raster screen projection: the resolution parameters of these two different three-dimensional image reproduction systems are expressed by values of the same order. Figures 2. References: 2 Russian.  
[284-6900]

UDC 621.391

#### USE OF SELECTIVE PROPERTIES OF OPTICAL HETERODYNING IN ACOUSTOOPTICAL DELAY LINES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 28, No 3, Mar 85 (manuscript received after completion 17 July 84)  
pp 70-72

LONSKIY, A.P., MOROZOV, S.V. and YAKOVLEV, V.I.

[Abstract] The paper is concerned with the use of the selective properties of optical heterodyning in acoustooptical lines for delay of electrical

signals. It is shown that these lines have a number of properties, difficult or impossible to obtain in other types of delay lines, e.g., the possibility of smooth variation of the delay time by both the mechanical and electrical method, and in the last-mentioned case the speed of returning can be made extremely rapid; absence of echo signals; significant wide-bandness. In practice, limitation of the bandwidth of the lines is principally caused by the frequency-dependent nature of the acoustooptical interaction in the process of heterodyning. (Use of optical heterodyning in the lines leads to complications and requires precise realization of its individual units.) Figures 1; references 6: 3 Russian, 3 Western (1 in Russian translation). [267-6415]

UDC 621.391.029.7

ADAPTIVE DETECTION OF OBJECTS OBSERVABLE THROUGH OPTICALLY NONHOMOGENEOUS MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 3 Aug 83) pp 337-340

SAFRONOV, A.N.

[Abstract] The problem of detecting an object located in generally optically nonhomogeneous medium is treated from the standpoint of an adaptive Bayes model. The algorithm involves calculating the ratio (its logarithm) of two probability density functionals, corresponding respectively to the two hypotheses of the object's presence or absence, and then maximizing this ratio with respect to all unknown parameters, including the object's space coordinates and orientation as well as shape and size. This procedure is demonstrated first on an object of known shape and then on one of a partly unknown shape, considering in each case a large object with almost specularly reflecting surface. Figures 2; references: 4 Russian. [220-2415]

UDC 621.373.826:533.9

RADIAL DISTRIBUTION OF GAIN AT 0.63  $\mu\text{m}$  WAVELENGTH IN NEON-HELIUM PLASMA UPON TRANSVERSE MICROWAVE DISCHARGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 30, No 2, Feb 85 (manuscript received 2 Mar 84) pp 404-406

ABRAMOV, V.P., MAZANKO, I.P., MANOSHKIN, Yu.V. and ULANOV, Ye.A.

[Abstract] Transverse microwave discharge for excitation of the active medium of He-Ne lasers (0.63  $\mu\text{m}$  wavelength), preferable to direct-current excitation, was studied in an experiment with variable microwave pumping

power. The main purpose was to determine the radial distribution of the gain, since the mean gain in a cross section of the active medium has already been measured by others. A glass tube with 0.7 mm wall thickness and 3 mm inside diameter was filled with a Ne:He= 1:15 mixture to a pressure of 4 mm Hg. Transverse discharge was produced by an external 465 MHz transistor oscillator through a 25 mm long strip line. The magnitude of gain was measured by the method of 100% pump modulation, this method having been appropriately modified for microwave discharge, and its radial distribution was measured at point 0.15 mm apart. At some threshold level  $P_0$  of microwave power, approximately 0.5 W, the discharge acquired the shape of an oval "blob" of length comparable with the tube diameter. With further increase of the microwave power, the blob became longer and then split before remerging again. Its length  $L$  increased linearly with the microwave power, while the intensity of lateral spontaneous radiation remained constant, until the first critical level  $P_1$  of microwave power, approximately 1.5 W, was reached. In this range the gain  $G$  also remained constant and the  $GL$  product increased correspondingly as a linear function of the microwave power. From there on the  $GL$  product increased at a decreasing rate to a constant level at the second critical level  $P_m$  of microwave power, approximately 3 W, while the intensity of lateral spontaneous radiation continued to increase beyond that microwave power level. The radial distribution of gain was found to slightly asymmetric, oblate along the X-axis. As the microwave power was increased from 1.03 W to 5.37 W, the single peak at the center of both X and Y profiles flattened while rising and eventually became a saddle between two lateral peaks. Figures 2; references 10: 9 Russian, 1 Western.

[220-2415]

UDC 621.396.22.029.7

#### SIGNAL AND BACKGROUND AT OUTPUT OF LASER RECEIVER

Moscow RADIOTEKHNIKA in Russian No 4, Apr 85 (manuscript received 17 Apr 1983) pp 3-6

TEPLYAKOV, I.M.

[Abstract] In literature concerned with laser systems of communication, detection, and ranging, basic attention is given to finding the probability distributions of signal and noise at the output of a receiving device. At the same time the signal at the output of the photodetector is very often subjected to narrow-band filtration, in connection with which it is necessary to remove the noise spectra at its output. In this case where there is an effect of the external background, the beat noise at the output of the photodetector must be taken into consideration. However, in existing literature this beat noise is not considered or is incorrectly taken into account. The present paper demonstrates that the noise spectrum at the laser receiver output consists of quantum noise and the beat noise spectra which is analogous to the noise spectrum of the beat of radio band receivers.

Figures 1; references: 4 Russian.

[257-6415]

## ELECTROMAGNETIC COMPATIBILITY

UDC 537.8:621.365.2

### DYNAMIC MODELS FOR ELECTROMAGNETIC COMPATABILITY OF ELECTRICAL LIGHT SOURCES

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 2, Mar-Apr 85 (manuscript received 2 Nov 84) pp 12-16

SHIDLOVSKIY, A.K., associated member of Academy of Sciences, Ukr SSR, director, Institute of Electrodynamics, Academy of Sciences, Ukrainian SSR, Kiev, KYRENNYY, E.G., doctor of technical sciences, chief of department, Donatz Polytechnical Institute, and ARUTYUNAYAN, A.G., engineer, Kanakersky Aluminum Plant, Yerevan.

[Abstract] An alteration of voltage and frequency at large terminals changes the condition of operation during artificial illumination and affects the life expectancy of the lamp. As a result, for evaluation of electromagnetic compatibility, development is studied of mathematical models of the process of conversion of electrical energy into light, changes of the life expectancy of lamps, and the effect on humans. The advisability of the dissemination of the idea of a dose of flicker at the high frequency range of change of the brightness of lamps is considered. Instead of the ripple factor, a universal indicator is proposed: a dose of flicker pulsation. The concept of a dose of pulsation enables pulsations of various forms and frequencies to be made equivalent. The results obtained made it possible to evaluate the effectiveness of the supply of luminous lamps by voltage of increased frequency. Figures 2; references 4: 3 Russian, 1 Western.  
[266-6405]

## RELIABILITY

UDC 621.396.6

### RELIABILITY-COST CRITERION OF EFFICIENCY OF MEASURES FOR PREVENTION OF DEGRADATION FAILURES IN RADIODEVICE EQUIPMENT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIODEVICE EQUIPMENT in Russian  
Vol 28, No 3, Mar 85 (manuscript received after revision 10 July 84) pp 91-92

ILLARIONOV, O.I., BERMAN, N.V.

[Abstract] The efficiency of measures for prevention of degradation failures can be evaluated by the magnitude of gain  $W = T_2/T_1$ , where  $T_2$  and  $T_1$  are the average full operating time with and without prevention of failure, respectively, with a fixed cost of expenditures on means concerned with prevention of failures. It is shown that with use of the criterion of gain in operating time, together with the criterion of the cost of expenditures on technical maintenance (or measures with respect to prevention) it is possible at an optimum to construct a system of forecasting control as well as at an optimum to select forecasting parameters. References: 3 Russian.  
[267-6415]

AEROSPACE & ELECTRONIC SYSTEMS

RADIO CARTOGRAPHY OF THE PLANET VENUS

Moscow RADIO in Russian No 4, Apr 85 pp 6-9

GROMOV, A.

[Abstract] This article presents a discussion of the possibilities of radio and electronics in mapping the surface of Venus. The participants were V. A. Kotelnikov and A. F. Begomolov, members of the engineering sciences, G. N. Petrov, candidate of physical-mathematical sciences, A. I. Sidorenko, candidate of engineering sciences, and O.N. Rzhiga, Doctor of Physical-Mathematical Sciences. The requirements for the radar equipment are described. The satellite equipment was designed to obtain radio imaging of the surface of Venus, and a radio altimeter was used to measure the altitude profile along the flightpath. The radar information processing system developed by the USSR Academy of Sciences Institute for Radioelectronics, which is based on an SN-4 control computer, is described.

Figures 3.

[290-6900]

SOLID STATE CIRCUITS

UDC 621.382.8

NUMERICAL ANALYSIS OF CHARGE TRANSFER FEATURES IN GALLIUM ARSENIDE  
DEVICES WITH BOUND CHARGES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROTEKHNIKA in Russian  
Vol 28, No 3, Mar 85 (manuscript received 25 May 84) pp 39-43

PROKORYEV, A.I.

[Abstract] An investigation is made of the principal factors affecting the dynamics of the charge transfer in gallium arsenide devices with a bound charge which have a latent channel, taking into account three transfer mechanisms (fringing field, self-induced drift, thermal diffusion) under conditions of saturation of drift velocity and at room temperature. Fulfillment of the condition of smoothness of the channel is considered. Figures 4; references 7: 1 Russian, 6 Western.  
[267-6415]

## CONTROL SYSTEMS

UDC 681.511.42.033.3

### STEADY-STATE ERRORS OF PULSE-WIDTH SYSTEMS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 4 Jan 84) pp 19-25

LUCHKO, S. V. and ANIKIN, V. Ya.

[Abstract] Simple exact or approximate analytical expressions are derived for the constant component of the steady-state error of pulse-width modulated systems of the first and second kind. The steady-state error of both systems is investigated through the transfer functions of the analog part of a pulse-amplitude modulated system. The conditions under which both systems are static or astatic are identified. The system employing pulse-width modulation of the first kind can be made astatic with respect to the input and perturbing effects by using a digital integrator. Figures 2. References: 2 Russian.

[296-6900]

UDC 681.3

### MICROPROCESSOR SYSTEM FOR IDENTIFYING PARAMETERS OF OBJECT

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 29 Jun 84) pp 30-33

KAPITANOV, V.L., Leningrad Institute of Aviation Instrument Engineering

[Abstract] The structure and operating algorithm are defined for a microprocessor system that identifies the parameters  $T$  and  $\zeta$  of an object described by the differential equation

$$T^2 x + 2\zeta T x + x = f \quad (1)$$

for different control inputs  $f$  assigned by the microprocessor system itself. Algorithms are proposed that automate the measurement of the dynamic characteristics of the object depending upon the control mode. The structural diagram of the system is presented, along with flowcharts of algorithms

for determining frequency, amplitude and attenuation. The proposed algorithms are validated by full-scale modeling. Figures 3. References: 2 Russian.  
[296-6900]

UDC 517.977.1

CONTROLLABILITY AND OBSERVABILITY OF AUTONOMOUS LUMPED SYSTEMS IN CLASS OF IMPULSE CONTROLS AND POINT OBSERVATIONS

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-MATEMATYCHNYKH NAVUK  
in Russian No 2, Feb 85 (manuscript received 6 Jun 83) pp 24-28

BORUKHOV, V. T., Institute of Heat- and Mass-Exchange imeni A.V. Lykov,  
Belorussian SSR Academy of Sciences

[Abstract] Algebraic controllability criteria are derived that make it possible to determine the sufficient and, in particular, the minimum number of pulse (control) application points that are fixed in time and that ensure the controllability of a linear dynamic system. The problem is similar to that of switching piecewise-constant controls that ensure the controllability of linear systems, where the number of switches, which is equal to the controllability index, is sufficient for controllability  $\mathcal{N}$ . The invariants of the impulse matrix over the ring of functions that are analytical in the vicinity of zero are constructed. A necessary and sufficient condition for  $\mathfrak{q}$ -controllability is identified. References: 8 Russian.  
[281-6900]

INDUSTRIAL ELECTRONICS & CONTROL INSTRUMENTATION

UDC 62-83:621.313

DETERMINATION OF REGION OF PARAMETERS OF ACTUATING ELECTRIC MECHANISM OF VARIABLE-STRUCTURE STEERING GEAR PROVIDING REQUIRED REACTION SPEED

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PROBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 1 Oct 84) pp 25-30

SMOLENGO, S. Yu., and GUSAKOV, V. I., Moscow Aviation Institute imeni S. Ordzhonikidze

[Abstract] A method is presented for determining the parameters of the actuating electric mechanism that govern the deflection of the output shaft of a variable-structure steering gear for a given amount of time. The movement of the output shaft is divided into two sectors: the sector in which the shaft accelerates to the steady-state speed, and a sector with movement at the steady-state speed until the required angle is reached. The parameters of the actuating mechanisms are found to be determined by the regulation time, as well as the optimum idling speed of the output shaft for which that time is shortest. The findings make it possible to design electric actuating mechanisms that provide the required speed. Figures 6. References:

5 Russian.

[296-6900]

AUTOMATIC SHUTOFF DEVICE FOR TYPE KPSM PACKAGE CONVEYOR

Moscow VESTNIK SVYAZI in Russian No 4, Apr 85 p 31

RYABOCHKIN, A.S., senior engineer, Production-Technical Laboratory, UFA Railroad Post Office

[Abstract] A device is described that automatically shuts down the KPSM package sorting conveyor after the last package has been processed, if the operator fails to shut the system off manually. The device, which consists of a thyratron electronic timing relay, operates automatically when the belt has made one complete revolution with no packages aboard. The schematic diagram of the device is presented and explained. The device is implemented on a board that is installed in the conveyor power cabinet. Figures 2. [288-6900]

COMPUTERS

UDC 681.323

INVESTIGATION OF OUTPUT OF SPECIAL-PURPOSE COMPUTATIONAL STRUCTURE FOR NETWORK ANALYSIS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 7, No 1, Jan-Feb 85  
(manuscript received 18 Oct 82) pp 13-19

KIREYEV, L. N., KOTLYARENKO, A. A. and PELEKHOV, S. P.

[Abstract] Models of special-purpose computers for network analysis are examined. Formulas for calculating their speed are derived and validated mathematically. Comparative graphs are constructed showing the difference in the problem solving time on different models as a function of the number of nodes and branches in the network under consideration. A computer employing dynamic distribution of the decision element among the branches of the modeled process is found to be significantly faster than other models.

Figures 4. References: 5 Russian.

[295-6900]

UDC 681.325.5-181.4

EXPANSION OF FUNCTIONAL CAPABILITIES OF MICROCOMPUTERS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 7, No 1, Jan-Feb 85  
(manuscript received 13 Oct 83 after revision) pp 25-30

SKLYAROV, V. A.

[Abstract] The structure and capabilities of microcomputers with distributed control, in which some of the operations are implemented in the microprocessor according to a stored program, and some are implemented by circuits outside the microprocessor using special microprograms, are examined. In the block diagram of the microcomputer, the controlled objects, random-access memory, and control memory are connected to the microprocessor via buses. The various functional blocks of the computer also interact over common buses: a one-way address bus, a two-way data bus, and a one-way control bus. The operating algorithm of the control microcomputer is described.

Figures 4. References: 6 Russian.

[295-6900]

UDC 681.3

IMPLEMENTATION OF DISCRETE FOURIER TRANSFORM ON VLSI DIGITAL SIGNAL PROCESSOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 2, Apr 85 (manuscript received 27 Sep 84) pp 34-40

VOLPERT, L. A., KUKHAREV, G. A. and STRAUTMANIS, G. F., Leningrad Institute of Precision Mechanics and Optics

[Abstract] The authors discuss the characteristics of the implementation of discrete Fourier transforms using small numbers of points on a special-purpose microprocessor consisting of a single-chip VLSI digital signal processor with analog input-output devices. The discrete Fourier transforms are performed for  $N=2, 3, 4, 5, 6, 7, 8, 9$ , and 16, using Winograd's method and the method of mutually prime factors. The improvements to digital signal processors proposed by the authors make it possible to use single-chip VLSI digital signal processors to implement different classes of orthogonal transforms. The internal structure of the processor imposes certain restrictions on the characteristics of the algorithms that can be implemented: RAM capacity makes it possible to implement algorithms with  $N$  of up to 32 for real input data and up to 16 for complex input data; ROM capacity makes it possible to implement discrete Fourier transform algorithms with  $N$  of up to 16 using discrete exponential functions, and  $N$  of up to 32 using complex rectangular functions. Figures 3. Tables 4. References 6: 4 Russian, 2 Western.

[296-6900]

UDC 681.323

MICROPROCESSOR-BASED FUNCTIONAL FREQUENCY-TO-CODE CONVERTER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 16 May 84) pp 40-43

LOKTYUKHIN, V. N., Ryazan Radiotechnical Institute

[Abstract] A microprocessor-based functional frequency-to-code converter is examined in which the form in which the information is represented and the nonlinear function is computed are implemented by software. The functional converter incorporates a microprocessor based on the KR580 LSI circuit, a clock, read-only and random-access memory, two eight-bit output registers, and an interrupt circuit. The structural diagram of the converter is presented, along with the flowchart of the functional conversion program. The functional converters based on microprogrammable microprocessors and single-chip microcomputers. Figures 2. References: 2 Russian.

[296-6900]

UDC 681.326.7

STATISTICAL ANALYSIS OF OPERATION OF INTEGRATED-CIRCUIT BUBBLE MEMORY UNIT

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 28, No 4, Apr 85 (manuscript received 27 Jul 84) pp 44-49

BELOV, L. B., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Statistical methods are proposed for testing the output signal of integrated circuit bubble memories in order to assess read-out accuracy and select microcircuits with reliable recording units, and to sort these microcircuits into groups according to optimal thresholds. Criteria are developed for a methodology for testing bubble memory units and predicting their operating reliability. The proposed test algorithm is based on the results of a series of experiments on reproducibility of the signal of the bubble memory unit; statistical analysis is used to predict the reliability of the read operation. A few minutes are required for testing, most of which is spent in ensuring the required sample size. Figures 4. References: 6 Russian.

[296-6900]

UDC 681.327

DATA RECEIVING/TRANSMITTING DEVICE FOR DIGITAL MEASUREMENT SYSTEM BASED ON K580IK80A MICROPROCESSOR

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-MATEMATYCHNYKH NAVUK in Russian No 2, Feb 85 (manuscript received 6 Sep 84) pp 45-48

PILIPOVICH, V. A., BOGACHEV, V. N. and YESMAN, A. K., Institute of Electronics, Belorussian SSR Academy of Sciences

[Abstract] A device is described for exchanging information between external sensors and displays and the MK-01 microcontroller, which is based on the K580IK80A microprocessor. The structural diagram of the device, which incorporates a memory, clock, and a state generator which serves as a one-byte register containing information about the type of instruction currently being executed by the microprocessor, is shown. The operating algorithm of the device is presented in flow chart form and explained. The system can be used for data acquisition, statistical processing, and display. Figures 2. References: 2 Russian.

[281-6900]

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